CHLORPYRIFOS (Dursban®, Lorsban®)

DIETARY EXPOSURE ASSESSMENT

HEALTH ASSESSMENT SECTION

MEDICAL TOXICOLOGY BRANCH

DEPARTMENT OF PESTICIDE REGULATION

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

MAY 8, 1992

EXECUTIVE SUMMARY

RISK ASSESSMENT

The risk assessment process consists of four aspects: hazard identification, dose response assessment, exposure evaluation, and risk characterization.

Hazard identification entails an evaluation of the toxicological properties of each pesticide. The dose response assessment then considers the chemical's toxicological properties and estimates the amount which could potentially cause an adverse effect. A basic premise of toxicology is that at a high enough dose, virtually all substances will result in some toxic manifestation. Although chemicals are often referred to as "dangerous" or "safe", as though these concepts were absolutes, in reality these terms describe chemicals which require low or high dosages, respectively, to cause toxic effects. Toxicological activity is determined in a battery of experimental studies which define the types of toxic effects which can be caused, and the exposure levels (doses) at which effects may be seen. State and federal testing requirements mandate that substances be tested at doses high enough to produce toxic effects, even if such testing involves chemical levels many times higher than those to which people might be exposed.

In addition to the intrinsic toxicological activity of the pesticide, the other parameters critical to determining risk are the level, frequency and duration of exposure. The purpose of the exposure evaluation is to determine the potential amount of pesticide likely to be delivered through the dietary route on an acute or chronic basis.

The risk characterization then relates the toxic effects observed in laboratory studies, conducted with high dosages of pesticide, to potential human exposures to low dosages of pesticide residues in the diet. The potential for possible adverse health effects in human populations is expressed as the margin of safety, which is the ratio of the dosage which produced no effect in laboratory studies to the theoretical dietary dosage.

ABSTRACT OF FINDINGS

Analyses of potential dietary exposure to chlorpyrifos residues have been conducted by the Department of Pesticide Regulation (DPR). The acute and chronic dietary exposure to primary residues on raw agricultural commodities (RACs) and secondary residues, which result from residues on animal feeds, have been assessed under the provisions of AB 2161 (Bronzan). The potential exposure to residues in RACs as consumed by members of specific population subgroups, including infants and small children, and the attendant margins of safety have been assessed.

DPR concludes the margins of safety, based on cholinergic signs in humans, for potential acute dietary exposure to chlorpyrifos residues on labelled-use commodities are adequate. Margins of safety, based on inhibition of brain cholinesterase activity in rats and dogs, for potential chronic dietary exposure to chlorpyrifos residues are also adequate.

A tolerance is the maximum, legal amount of a pesticide residue that is allowed on a raw or processed agricultural commodity, or in an animal tissue used for human consumption. Under AB 2161, DPR has calculated the margins of safety associated with potential acute dietary exposure to chlorpyrifos on each RAC at tolerance. The tolerance for chlorpyrifos on apples provides adequate margins of safety for all population subgroups with the possible exception of non-nursing infants, less than the age of 1. However, the tolerance is for whole apples. Yet non-nursing infants consume apples predominantly as processed foods such as apple sauce or juice. Thus, the actual margin of safety, based on tolerance, is considered adequate. All other tolerances for chlorpyrifos on label-approved commodities provide adequate margins of safety for potential acute dietary exposure for all population subgroups.

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SUMMARY

Chlorpyrifos (Trade name- Dursban® or Lorsban®) (O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate) was developed by Dow Chemical Company, and initially registered by the U.S. Environmental Protection Agency and by the State of California for foliar use on alfalfa and cotton. Both foliar and soil applications are used on sorghum, soybeans, sugarbeets, and sunflowers. Soil application of chlorpyrifos is used for peanuts. The active ingredient is used to control aphids, armyworms, billbugs, chinch bugs, common stalk borer, corn borers, corn earworm, corn rootworm adults, cutworms, flea beetle adults, grasshoppers, and the lesser cornstalk borer. Chlorpyrifos is used on dormant fruit trees for peach tree borer and overwinter scale. Slurry seed treatment is used for sweet corn maggot. Chlorpyrifos is used to control fire ants, ornamental plant insects, stored product insects, and turf insects, as a soil insecticide for billbugs, corn rootworms, cutseed corn maggot, symphylan, and wireworm. Chlorpyrifos is also used on pests in field, fruit, nut and vegetable crops. In 1989, approximately 2,104,724 pounds of chlorpyrifos were sold in California.

Chlorpyrifos is an organophosphate insecticide which exerts its pharmacological activity primarily through the binding of the enzyme acetylcholinesterase via phosphorylation leading to inhibition of enzyme activity. Acetylcholinesterase normally metabolizes acetylcholine to acetate and choline, which results in the termination of stimulation of dendritic nerve endings and motor endplates on muscles. Acetylcholine is the neuro-chemical transmitter at endings of postganglionic parasympathetic nerve fibers, somatic motor nerves to skeletal muscle, preganglionic fibers of both parasympathetic and sympathetic nerves, and certain synapses in the central nervous system.

Analyses of potential dietary exposure to chlorpyrifos residues have been conducted by the Department of Pesticide Regulation (DPR). The acute and chronic dietary exposure to primary residues on raw agricultural commodities and secondary residues, which result from residues on animal feeds, have been calculated under the provisions of AB 2161 (Bronzan). The risks from potential exposure to residues in agricultural commodities as consumed by members of specific population subgroups, including infants and small children, have been assessed.

Estimates of short term toxic effects from potential acute dietary exposure were based on a No-Observed-Effect-Level (NOEL) of 0.5 mg/kg for cholinergic signs (dry mouth, salivation, diaphoresis, abdominal pain, drowsiness, nausea and vomiting) from human studies. Assessment of long term toxic effects from potential chronic dietary exposures was based on a NOEL of 1.0 mg/kg-day for depression of brain cholinesterase activity in a combined chronic/oncogenicity study in rats and a chronic toxicity study in dogs. The margins of safety (MOSs) ranged from 52 for nursing infants (<1 year) to 205 for males (20 years and older) for potential acute dietary exposures to chlorpyrifos. MOSs for potential chronic dietary exposure to chlorpyrifos ranged from 2198 to 8065 for most population subgroups. These MOSs were considered adequate for protection from the adverse health effects of chlorpyrifos.

The tolerance for chlorpyrifos on apples provides adequate margins of safety (MOS$\geq$11) for all population subgroups with the possible exception of non-nursing infants, less than the age of 1 (MOS=8). However, the tolerance is for whole apples. Yet, non-nursing infants consume apples predominantly as processed foods such as apple sauce or juice. Thus, the actual margin of safety, based on tolerance, is considered adequate. All other tolerances for chlorpyrifos on the most highly consumed commodities provide adequate margins of safety (ranging from 11 to 28,839) for potential acute dietary exposure for all population subgroups.

INTRODUCTION

Section 13060 of the Food and Agricultural Code of California requires the Department of Pesticide Regulation (DPR) to conduct an assessment of dietary risks associated with the consumption of produce and processed foods treated with pesticides. This assessment requires integration of data on short term and long term health effects of pesticides with relevant residue data to quantify the potential risk of consuming treated foods.

Chlorpyrifos (Trade name- Dursban® or Lorsban®) (O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate) was developed by Dow Chemical Company, and registered by the U.S. Environmental Protection Agency and by the State of California for foliar use on alfalfa and cotton. Both foliar and soil applications are used on sorghum, soybeans, sugarbeets, and sunflowers. Soil application of chlorpyrifos is used for peanuts. The active ingredient is used to control aphids, armyworms, billbugs, chinch bugs, common stalk borer, corn borers, corn earworm, corn rootworm adults, cutworms, flea beetle adults, grasshoppers, and the lesser cornstalk borer. Chlorpyrifos is used on dormant fruit trees for peach tree borer and overwinter scale. Slurry seed treatment is used for sweet corn maggot. Chlorpyrifos is used to control fire ants, ornamental plant insects, stored product insects, and turf insects, as a soil insecticide for billbugs, corn rootworms, cutseed corn maggot, symphylan, and wireworm. Chlorpyrifos is also used on pests in field, fruit, nut and vegetable crops. In 1989, approximately 2,104,724 pounds of chlorpyrifos were sold in California (CDFA, 1990a).

Chlorpyrifos is an organophosphate insecticide which exerts its pharmacological activity primarily through the binding of the enzyme acetylcholinesterase via phosphorylation leading to inhibition of enzyme activity (Ellenhorn and Barceloux, 1988). Acetylcholinesterase (AChE) is also called specific or true cholinesterase, and is found near cholinergic synapses in some organs (e.g. lung, spleen, brain) and in red blood cells (Lefkowitz *et al*., 1990). AChE normally metabolizes acetylcholine to acetate and choline, which results in the termination of stimulation of dendritic nerve endings and motor endplates on muscles. Acetylcholine is the neuro-chemical transmitter at endings of postganglionic parasympathetic nerve fibers, somatic motor nerves to skeletal muscle, preganglionic fibers of both parasympathetic and sympathetic nerves, and certain synapses in the central nervous system (Murphy, 1986).

Butyrylcholinesterase (BuChE), also known as "cholinesterase" (ChE), serum esterase, or pseudo-cholinesterase, only occurs to a limited extent in neuronal elements of the central and peripheral nervous systems. It is also present in the plasma, liver, and other organs; however, its physiological function is unknown (Lefkowitz *et al*., 1990). Therefore, any reference in this document to "cholinesterase", without specifically indicating that the enzyme is serum or plasma cholinesterase (ChE), should be interpreted as acetylcholinesterase (AChE).

The inhibition of acetylcholinesterase results in accumulation of endogenous acetylcholine in nerve tissue and effector organs. In acutely toxic episodes, muscarinic, nicotinic and central nervous system (CNS) receptors are stimulated with characteristic signs and symptoms occurring throughout the peripheral and central nervous systems (Ellenhorn and Barceloux, 1988; Lefkowitz *et al*., 1990). Muscarinic effects can include increased intestinal motility, bronchioconstriction, increased bronchial secretions, bladder contraction, miosis, secretory gland stimulation and bradycardia. Nicotinic effects include muscle weakness, twitching, cramps and general fasciculations. Accumulation of acetylcholine in the CNS can cause headache, restlessness, insomnia, anxiety and other non-specific symptoms. Severe poisoning results in slurred speech, tremors, ataxia, convulsions, depression of respiratory and circulatory centers and, eventually, coma and death.

TOXICOLOGICAL PROFILE

PHARMACOKINETICS

Summary- The amount of ingested chlorpyrifos which is absorbed appears to vary between species. Approximately 70% of an oral dose of chlorpyrifos was excreted in the urine of humans, and 90% in urine of rats. Chlorpyrifos was rapidly converted to 3,5,6-trichloro-2-pyridinol in humans, with measured metabolite concentrations always greater than the parent compound. The highest tissue concentrations were found in the liver and kidney, but chlorpyrifos did not bioconcentrate in tissue. The principal route of excretion in humans, rats and goats was through the urine. Less than 0.1% of the dose administered to goats was found in the milk.

Oral- rat

Male Wistar rats received a single dose (50 mg/kg) of ^{36}[Cl] chlorpyrifos (98% pure) by gavage (Smith *et al.*, 1967). The highest concentrations of radiolabelled compound were found in the liver and the kidneys. High levels were also found in the fat and the skin. Approximately 90% of the administered label was excreted in the urine, 80% within the first 24 hours, and the remainder was eliminated in the feces.

Oral- rat

Rats (strain unknown) metabolized single oral doses of ^{14}[C]- chlorpyrifos to at least 3 major metabolites (Baake *et al.*, 1976). Within 48 hours, the urine contained about 90 percent of the administered dose in the form of metabolites. The three metabolites were identified as the glucuronide of 3,5,6-trichloro-2-pyridinol (80% of urinary label), a glycoside of 3,5,6-trichloro-2-pyridinol (4%), and 3,5,6-trichloro-2-pyridinol (12%).

Oral- human

Six male volunteers were given a single oral dose of 0.5 mg/kg chlorpyrifos (99.8% pure) (Nolan *et al.*, 1984). No clinical signs were noted, but plasma cholinesterase was depressed 85% twelve to twenty-four hours after ingestion of the dose. Blood concentrations of chlorpyrifos were consistently lower than the concentrations of its principal metabolite, 3,5,6-trichloro-2-pyridinol (3,5,6-TCP). The principal excretion route was through the urine; however, only metabolites were found. The percentage of the initial oral dose recovered as 3,5,6-TCP in the urine was 70$\pm$11. The mean half-life in the body was 26.9 hours.

Oral- goat

Two female goats were fed ^{14}[C]-ring labeled chlorpyrifos via capsule for 10 days (Glas, 1981). The doses were administered twice daily at a level equivalent to 16 to 25 ppm in the feed. Recovery of administered radioactivity averaged 85.6%. Most of the recovered radioactivity (80.3%) was in the urine, with smaller amounts in feces (3.6%), gut (0.9%), tissues (0.8%), and milk (0.1%). Most of the radioactivity was excreted as the beta-glucuronide conjugate of 3,5,6-trichloro-2-pyridinol, with smaller amounts of the unconjugated compound. Analysis of the fat indicated that 75% of the remaining radioactivity was in the form of chlorpyrifos.

ACUTE TOXICITY

The acute toxicity of technical grade chlorpyrifos is summarized in Table 1.

TABLE 1 - Acute oral toxicity of chlorpyrifos (LD50s).

			Technical Material	
Species	Sex	Category[a]	Dosage (mg/kg)	Reference
Rat	M/F	II	69-276	(Gaines, 1969; Dow, 1985)
Guinea pig	M/F	II	299-850	(Dow, 1985)
Rabbit	M/F	III	1,000-2,000	(Dow, 1985)

The range of acute oral toxicity (LD50) for liquid formulations in male and female rats was 205-1414 mg/kg (Anspach, 1978; Carreon and New, 1981; Carreon *et al.*, 1982a; Carreon *et al.*, 1981; Carreon and Quast, 1980; Henck *et al.*, 1980; Lockwood and Blogg, 1978; Moreno *et al.*, 1981; Rampy and Keeler, 1973; Rampy *et al.*, 1973; Rosenfeld, 1985; Vaughn *et al.*, 1976b; Dow, 1982); for granular formulations it was 224-1630 mg/kg (Carreon *et al.*, 1982b; Keeler, 1975; Mizell and Lomax, 1988; Norris, 1972); for wettable powders it was 180-235 mg/kg (Vaughn *et al.*, 1976a; Gabriel, 1988); and for sprays it was 710->5000 mg/kg (Beck, 1982; Costello and Gilman, 1981; Dow, 1982; Kreuzmann and Doyle, 1980; Lazzara and Helfried, 1975; Norris and Leong, 1970; Robbins and Rosenfeld, 1988).

SUBCHRONIC TOXICITY

Diet- dog

A sub-chronic study evaluating the effects of chlorpyrifos in the diet of dogs indicated cholinergic signs (dilated and watery eyes, loose stools, vomiting, rough coats, labored breathing, and tremors of the legs and head) with a dosage of 8 mg/kg-day at 45 days (Dow, 1964). Plasma cholinesterase activity was depressed 91%, and red blood cell cholinesterase activity was depressed 95% in all dogs at all doses. No cholinergic signs were seen following a dosage of 1.8 mg/kg-day for 93 days.

Diet- rat

In a sub-chronic study, Fischer 344 rats (10 rats/sex/dose) were placed on a diet containing chlorpyrifos at 0, 0.1, 1.0, 5.0 or 15 mg/kg-day for 13 weeks (Szabo *et al.*, 1988). The females in the highest dosage group (15 mg/kg-day) had a slight increase in perineal yellowish staining, but no explicit indications of cholinergic signs were noted. Both plasma cholinesterase and red blood cell cholinesterase activities in this group were significantly ($P<0.001$) depressed (95% and 51%, respectively) compared to controls. Both plasma cholinesterase (95%) and red blood cell cholinesterase (49%) activities were significantly depressed at 5 mg/kg-day in both sexes. Therefore, the sub-chronic NOEL for inhibition of cholinesterase activity was 1 mg/kg-day for both sexes.

CHRONIC TOXICITY/ONCOGENICITY

Diet- dog

In a chronic dog study, beagles (4 dogs/sex/group) were fed for 2 years on a diet containing 0, 0.33, 1, 3.3, 33 or 100 ppm (approximately 0, 0.01, 0.03, 0.1, 1.0 or 3 mg/kg-day) chlorpyrifos (97.2%

pure) (McCollister *et al.*, 1971). No cholinergic signs, or other adverse effects were reported at any of the doses. Brain cholinesterase activity was depressed 20%, and red blood cell cholinesterase activity was reduced 76% in the 3.0 mg/kg-day dose group (Table 2). The No Observed Effect Level (NOEL) for brain cholinesterase activity depression was 1 mg/kg-day. The NOELs for red blood cell cholinesterase and plasma cholinesterase activities were 0.03 mg/kg-day and 0.01 mg/kg-day, respectively. This study was acceptable under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Diet- rat

Male and female rats (Fischer-344) (10/sex/dose designated for 1 year interim sacrifice: 50/sex/dose designated for 2 year duration) in a chronic study were fed a diet containing chlorpyrifos (98.5% pure) at 0, 0.05, 0.1, 1.0 or 10 mg/kg-day (Young and Grandjean, 1988). No evidence of chemically induced oncogenicity was observed. At the highest dose (10 mg/kg-day), there was a significant reduction in body weight, a slight increase in diffuse retinal degeneration, and a significant ($P<0.001$) 50% reduction in brain cholinesterase activity (Table 3). No cholinergic signs were reported. The NOELs for depression of cholinesterase activity were: for brain, 1 mg/kg-day; for red blood cell, 0.1 mg/kg-day; and for plasma, 0.05 mg/kg-day. This study was acceptable under FIFRA.

TABLE 2 - Cholinesterase Inhibition in Beagle Dogs Exposed to Chlorpyrifos in Their Diet for Two Years[a]

Plasma Cholinesterase Activity, % Inhibition

Sex	Study Duration (mo.)	Dosage (mg/kg-day) 0.01	0.03	0.1	1.0	3.0
Male	6	1	19*	46**	56**	83**
	12	3	27*	46**	61**	83**
	18	2	23	44	58	71
	24	2	23	52*	69**	87**
Female	6	0	27*	44**	57**	66**
	12	0	0	28*	41**	65**
	18	0	6	30	58	67
	24	0	22	28	50**	67**

Red Blood Cell Cholinesterase Activity, % Inhibition

Sex	Study Duration (mo.)	Dosage (mg/kg-day) 0.01	0.03	0.1	1.0	3.0
Male	6	24	0	6	64	73
	12	19	0	11	64**	76**
	18	22	2	27	69	80
	24	14	0	27	68**	83**
Female	6	0	13	30	75	71
	12	3	3	24*	68**	73**
	18	0	1	22	58	78
	24	6	6	41*	66**	70*

Brain Cholinesterase Activity, % Inhibition

Sex	Study Duration (mo.)	Dosage (mg/kg-day) 0.01	0.03	0.1	1.0	3.0
Male	24	1	7	8	7	20*
Female	24	0	0	0	0	19*

a/ Data from McCollister *et al.*, 1971; cholinesterase inhibition was expressed as percent of concurrent control

* Significantly different from control by Dunnett's Test, $p<0.05$

** Significantly different from control by Dunnett's Test, $p<0.01$

TABLE 3 - Cholinesterase Inhibition in Fischer Rats Exposed to Chlorpyrifos in Their Diet for Two Years[a]

Plasma Cholinesterase Activity, % Inhibition

Sex	Study Duration (mo.)	Dosage (mg/kg-day) 0.05	0.1	1.0	10
Male					
	6	4	5	39*	56**
	12	5	2	73**	87**
	18	7	20	63**	87**
	24	8	14	60**	80**
Female					
	6	2	9	65**	83**
	12	0	13*	86**	95**
	18	1	14*	70**	88**
	24	0	5	60**	82**

Red Blood Cell Cholinesterase Activity, % Inhibition

Sex	Study Duration (mo.)	Dosage (mg/kg-day) 0.05	0.1	1.0	10
Male					
	6	0	11	24*	24*
	12	0	7	33	37
	18	0	5	33*	29*
	24	0	0	14	26*
Female					
	6	7	0	0	12
	12	12	0	18	41*
	18	0	0	22	18
	24	0	13	16	20

Brain Cholinesterase Activity, % Inhibition

Sex	Study Duration (mo.)	Dosage (mg/kg-day) 0.05	0.1	1.0	10
Male					
	12	6*	7*	9*	58**
	24	0	0	0	56**
Female					
	12	2	0	5*	61**
	24	0	0	4	57**

a/ Data from Young and Grandjean, 1988; cholinesterase inhibition was expressed as percent of concurrent control

* Significantly different from control by Dunnett's Test, $p<0.05$

** Significantly different from control by Dunnett's Test, $p<0.01$

REPRODUCTIVE TOXICITY

Diet- rat

Chlorpyrifos (97.8% pure) was administered in the diet at dosages of 0, 0.1, 1.0 or 5.0 mg/kg-day to Sprague-Dawley rats (30 sex/group) 7 days/week for two generations (Breslin *et al.*, 1991). The original parental generation (F_0) were exposed for 10 weeks prior to mating, and the F_1 adults were dosed 12 weeks prior to mating. No adverse reproductive effects were observed, though F1 pup weights were significantly ($P<0.05$) reduced (10-11%) at the highest dosage. Brain cholinesterase activity was significantly ($P<0.05$) inhibited (48-58% compared to controls) at the highest dosage, as were plasma and red blood cell cholinesterase activities (Table 4). The NOELs for depression of cholinesterase activity were: for brain, 1 mg/kg-day; for red blood cell, 0.1 mg/kg-day; and for plasma, 0.1 mg/kg-day. This study was acceptable under FIFRA.

DEVELOPMENTAL TOXICITY

Gavage- Rat

Chlorpyrifos (96.6% pure) was administered to Fischer 344 rats by gavage at 0, 0.1, 3.0, or 15 mg/kg-day on days 6-15 of gestation (Ouellette *et al.*, 1983). The maternal NOEL for cholinergic signs (excessive salivation, urination, defecation, and lacrimation) was 3.0 mg/kg. Maternal red blood cell and plasma cholinesterase activities were depressed 74% and 89%, respectively, at 3.0 mg/kg. Therefore, the maternal NOEL for depression of red blood cell and plasma cholinesterase activity was 0.1 mg/kg. The developmental NOEL was greater than 15 mg/kg, as no toxic developmental effects were noted. This study was acceptable under FIFRA.

Gavage- Mouse

CF-1 mice received chlorpyrifos (96.8% pure) by gavage at 0, 0.1, 1.0, 10 or 25 mg/kg-day on days 6-15 of gestation (Deacon *et al.*, 1979). The NOEL for cholinergic signs (tremors, salivation) was 1 mg/kg. Plasma cholinesterase activity was significantly ($P<0.05$, Dunnett's test) depressed (69%) at 1 mg/kg. The NOEL for plasma cholinesterase activity depression was 0.1 mg/kg. Red blood cell cholinesterase activity was significantly ($P<0.05$) depressed (40%) at 10 mg/kg. The NOEL for depression of red blood cell cholinesterase activity was 1 mg/kg. At a dose of 25 mg/kg, fetal length and weight were significantly ($P<0.05$) decreased compared to controls, and delayed ossification in the skull and sternebrae were noted. The NOEL for developmental effects was 10 mg/kg. This study was acceptable under FIFRA.

GENOTOXICITY

Mutagenicity studies of chlorpyrifos in bacteria and Chinese hamster ovarian cells were negative (Bruce and Zempel, 1986; Mendrala, 1985; Simmon *et al.*, 1977b). Chlorpyrifos did not cause either chromosomal damage or DNA damage in any in vivo studies or most in vitro studies (Gollapudi *et al.*, 1985; McClintock and Gollapudi, 1989; Simmon *et al.*, 1977c). One in vitro study indicated potential DNA damage caused by chlorpyrifos, but individual data were lacking (Simmon *et al.*, 1977a). Consequently, the genotoxic potential of chlorpyrifos is considered equivocal.

NEUROTOXICITY

Although the hens at the highest gavage dose (10 mg/kg-day) exhibited weight loss, diminished egg laying capacity, and transient abnormal gait, there was no histopathological evidence of delayed distal neuropathy (Barna-Loyd *et al.*, 1986). More recent studies in hens utilizing dosages 60-90 mg/kg (4-6 times the estimated LD50), necessitating pralidoxime injections to keep most of the hens alive, have yielded behavioral, but no histological indications of delayed polyneuropathy (Capodicasa *et al.*, 1991). In

the absence of histopathologic changes in nerves, transient behavioral anomalies are not convincing evidence that chlorpyrifos causes classical organophosphate-induced delayed neuropathy (Ellenhorn and Barceloux, 1988).

TABLE 4 - Cholinesterase Inhibition in Sprague-Dawley Rats Exposed to Chlorpyrifos in Their Diet for Two Generations[a]

Plasma Cholinesterase Activity, Mean % Inhibition

Sex	Generation	Dosage (mg/kg-day) 0.1	1.0	5
Male				
	F_0	15	44**	61**
	F_1	19	43**	64**
Female				
	F_0	21	59**	67**
	F_1	15	49**	72**

Red Blood Cell Cholinesterase Activity, Mean % Inhibition

Sex	Generation	Dosage (mg/kg-day) 0.1	1.0	5
Male				
	F_0	5	69*	70*
	F_1	13	67*	81*
Female				
	F_0	0	65*	70*
	F_1	0	66*	75*

Brain Cholinesterase Activity, Mean % Inhibition

Sex	Generation	Dosage (mg/kg-day) 0.1	1.0	5
Male				
	F_0	0	6	48*
	F_1	0	4	53*
Female				
	F_0	0	3	49*
	F_1	1	5	58*

a/ From Breslin *et al.*, 1991; cholinesterase inhibition was expressed as percent of concurrent control
* Significantly different from control by Dunnett's Test, $p<0.05$
** Significantly different from control by Wilcoxon's Test, $p<0.05$

HAZARD IDENTIFICATION

The NOEL for human cholinergic signs, based on a human pharmacokinetic study with a single dose administered to each of six human volunteers, was 0.5 mg/kg (Nolan *et al.*, 1984). No cholinergic signs were noted, but plasma cholinesterase activity was depressed 85%. Even though no higher dosages were tested, this dose (0.5 mg/kg) was considered a NOEL for cholinergic signs in humans. In a subchronic dog study, acute cholinergic signs were not observed at either 1.8 or 8 mg/kg-day, even though plasma cholinesterase activity was depressed 91% and red blood cell cholinesterase activity was 95% inhibited (Dow, 1964). The NOEL for maternal toxicity, as evidenced by cholinergic signs (salivation, defecation, urination, lacrimation), in a study of rat teratogenicity was 3 mg/kg (Ouellette *et al.*, 1983). The NOEL for maternal toxicity, as evidenced by cholinergic signs (tremors, salivation), in the mouse teratogenicity study was 1 mg/kg (Deacon *et al.*, 1979). The NOEL for maternal red blood cell and plasma cholinesterase activity depression (LOEL = 1 mg/kg; 74% and 89% inhibition, respectively) in the rat was 0.1 mg/kg. In mice, the NOEL for maternal red blood cell cholinesterase activity depression was 1 mg/kg (LOEL = 10 mg/kg; 40% inhibition), and the NOEL for maternal plasma cholinesterase depression was 0.1 mg/kg (LOEL = 1 mg/kg; 69% inhibition).

The human NOEL of 0.5 mg/kg for cholinergic signs was used as the toxicological basis for the acute dietary assessment. Although both the rat and mouse teratogenicity studies used several doses of chlorpyrifos to more precisely define an acute NOEL, the human NOEL was chosen to avoid using an uncertainty factor for extrapolating from effects in laboratory animals to humans.

No adverse effects of chlorpyrifos on laboratory animals were noted in any of the chronic exposure studies. The depression of plasma or red blood cell cholinesterase activities are indications of exposure to a toxic substance, but their toxicological significance is controversial (USEPA, 1990). A statistically significant depression of brain cholinesterase activity on the order of 50% is usually associated with cholinergic signs (Bignami *et al.*, 1975), and thus may be considered an adverse effect (USEPA, 1988). The NOELs for depression of brain cholinesterase activity following chronic dietary exposure to chlorpyrifos were 1 mg/kg-day for both rats (LOEL = 10 mg/kg-day; 56-61% inhibition) and dogs (LOEL = 3 mg/kg-day; 19-20% inhibition)(Young and Grandjean, 1988; McCollister *et al.*, 1971). This NOEL, 1 mg/kg-day for brain cholinesterase inhibition in rats and dogs, was used for the assessment of potential human chronic dietary exposure to chlorpyrifos. The USEPA RfD is 0.003 mg/kg-day based on inhibition of plasma cholinesterase activity in the dog study (USEPA, 1991).

EXPOSURE ASSESSMENT

Residue Data

Data for potential pesticide residues associated with USEPA label-approved direct food uses, as well as information about any possible secondary residues in animal tissues, are necessary for estimating human dietary exposures. The greatest reliance is generally placed on residue data from surveillance programs operated by the DPR and Federal agencies. If no residue data are available from the surveillance programs, the DPR relies on residue information which is generated by the registrant from field trials. These field studies are generally conducted to establish tolerances for specific raw agricultural commodities, and, therefore, are performed to obtain the highest potential residue under the conditions (e.g. highest application rate, shortest pre-harvest interval) detailed on the product label. In the absence of any measured residues, the DPR dietary exposure assessments utilize surrogate data from the same crop group as defined by USEPA, or theoretical residues equal to USEPA tolerance values (Appendix B).

The DPR has four monitoring programs: 1) priority pesticide 2) preharvest monitoring 3) produce destined for processing, and 4) marketplace surveillance. The priority pesticide program focuses on pesticides of health concern, as determined by DPR Enforcement and Medical Toxicology Branches. Samples are collected from fields known to have been treated with particular pesticides. The preharvest monitoring program routinely examines the levels of pesticides on raw agricultural commodities in the

fields at any time during the growth cycle. These data are not used as they are not necessarily from the last application of the pesticides. Samples of produce which is destined for processing are collected in the field no more than 3 days prior to harvest, or at harvest, or post-harvest but before processing. For the marketplace surveillance program, samples are collected at the wholesale and retail levels, and at the point of entry for imported foods. The California Department of Food and Agriculture collects animal feed, beef, pork, poultry, eggs and dairy products for pesticide residue analysis. These data, and the residue information from programs 1 and 3, are preferred for human dietary assessments as they are a more realistic estimate of what people may actually consume in their diet. While not routinely used in the dietary assessments, the data for imported commodities from the market surveillance program can be used to evaluate potential dietary exposure from pesticides not registered for use in California. Residue data above established tolerances are not utilized in the DPR dietary exposure assessments.

The U. S. Food and Drug Administration (FDA) has two monitoring programs for determining residues in food: 1) regulatory monitoring, and 2) a total diet study. The former program, like the DPR marketplace surveillance program, examines produce at the wholesale and retail levels of trade, as well as imported produce at the point of entry. When these data are available, the residue values are averaged with the data obtained from the DPR programs 1, 3, and 4 (above). The total diet study determines residues in foods after they have been prepared for consumption. These data, while being closest to actual residues consumed, are derived mostly from prepared foods (mixtures) or tend to have other limitations which restrict their absolute utilization in the dietary assessments.

The National Residue Program of the U. S. Department of Agriculture (USDA) provides data for potential secondary pesticide residues in meat and poultry. These residues can occur from farm animals consuming commodities or by-products in their feed.

Dietary exposure for chlorpyrifos has been estimated using DPR marketplace surveillance data and focused monitoring data from 1987 to 1989, FDA tabletop and marketplace surveillance data, and the USDA meat inspection program. It was assumed that chlorpyrifos was used to treat 100% of the crops for which there are USEPA approved labelled direct food uses.

Acute Exposure

For calculations of potential acute dietary exposure, the highest measured residue values for each commodity were used. If residue values exceeded the tolerance level, then the tolerance level was used as a surrogate for the highest observed value. If surveillance data did not indicate any detectable residues, then the minimum detection limit (approximately 0.05 ppm for DPR, 0.01 ppm for FDA, 0.05 ppm for USDA) for chlorpyrifos was used. If measured values were not available, then tolerances were used as a default procedure. The following assumptions are made in using measured residue values: a) the residue level does not change over time, b) residue concentrations are not decreased when the raw agricultural commodity (RAC) is washed, c) processing of RACs into various food forms does not reduce pesticide residues, and d) individuals may consume several foods that each contain the highest reported residues.

Acute dietary exposure analyses were conducted using the Exposure-4® software program developed by Technical Assessment Systems, Inc (TAS). The Exposure-4® software program estimates the distribution of user-day exposures to pesticide residues for the overall U.S. population and specific subgroups (TAS, 1990). A user-day is any day in which food from the residue list is consumed. The analysis uses actual, individual food consumption data, as reported in the 1987-88 USDA Nationwide Food Consumption Survey (USDA, 1987-88). Potential acute dietary ingestion of chlorpyrifos for all labelled uses, based on the 95th percentile of user-day exposures for all population subgroups, ranged from 2.4 to 9.6 *u*g/kg-day (Table 5). Nursing infants, less than 1 year of age, potentially had the highest acute dietary exposure to chlorpyrifos. The complete acute dietary exposure analysis is presented in Appendix C.

TABLE 5 - Potential acute and chronic dietary exposures to chlorpyrifos

Population Subgroup	Exposure Dosage (*u*g/kg-day)	
	Acute[a]	Chronic[b]
Western Region	3.7	0.19
Nursing Infants (<1 yr)	9.6	0.12
Non-Nursing Infants (<1 yr)	7.7	0.36
Children (1-6 yrs)	6.9	0.46
Children (7-12 yrs)	4.6	0.30
Female (13+ yrs/pregnant/not nursing)	2.7	0.15
Female (13+ yrs/nursing)	2.5	0.17
Female (13-19 yrs/not pregnant/not nursing)	2.9	0.17
Female (20+ yrs/not pregnant/not nursing)	2.6	0.14
Males (13-19 yrs)	2.9	0.19
Male (20+ yrs)	2.4	0.15

a/ Based on 95th exposure percentile for all user-day population subgroups. See Appendix C for residue file, other population subgroups and percentiles.

b/ Based on the annual average daily dosage for all population subgroups. See Appendix D for residue file and other population subgroups.

Chronic Exposure

Potential chronic dietary exposure was estimated using the arithmetic mean of measured residues and residues below the limit of detection for each RAC. RACs with undetectable levels of chlorpyrifos residues were assigned residue values of 0.05 ppm [50% of the minimum detection limit (MDL)]. The potential chronic dietary exposure was calculated using the Exposure-1® software (TAS, 1985). The Exposure-1® program estimates the annual average daily dosage for each of the population subgroups. The food consumption data for the chronic analysis were also derived from the U.S.D.A. 1987-88 Nationwide Food Consumption Survey. The foods and food-forms, and their respective residue amounts used in the analyses are presented in Appendix D.

In the absence of data to the contrary, the assumptions in the calculation of chronic dietary exposure were: a) the residue level does not change over time, b) residues are not reduced by washing the RAC, c) processing into various food forms does not reduce residue levels, d) individuals will consume foods that contain the average reported residues, and e) exposures to a commodity at all reported residue levels do occur, i.e. commodities with this average calculated residue levels are consumed every day at

an annual average level (dosage). The mean potential daily dietary exposure for all population subgroups ranged from 0.14 to 0.46 *u*g/kg-day (Table 5). The population subgroup of children, ages 1 to 6 years, had the highest potential exposure. The complete chronic dietary exposure analysis is presented in Appendix D.

CHARACTERIZATION OF RISK

Acute Exposure

The Margin of Safety (MOS), defined as the ratio of the NOEL to the potential exposure dosage, was calculated for acute exposures of the various population subgroups using DPR survey data of actual residues present in foodstuffs (Table 6, Appendix A). The MOS for potential acute dietary risk for the highest exposed population subgroup, nursing infants less than 1 year of age, was estimated to be 52, based on a NOEL of 0.5 mg/kg-day for cholinergic signs in a study of human volunteers. All other population subgroups had margins of safety greater than 65 (Appendix C).

TABLE 6 - Margins of safety from potential acute and chronic dietary exposure to chlorpyrifos

Population Subgroup	Margin of Safety	
	Acute[a]	Chronic[b]
Western U.S.	134	5155
Infants (<1 yr/nursing)	52	8065
Infants (<1 yr/non-nursing)	65	2786
Children (1-6 yrs)	72	2198
Children (7-12 yrs)	108	3378
Female (13+ yrs/pregnant/not nursing)	183	6897
Female (13+ yrs/nursing)	199	5952
Female (13-19 yrs/not pregnant/not nursing)	170	5917
Female (20+ yrs/not pregnant/not nursing)	190	6993
Male (13-19 yrs)	175	5319
Male (20+ yrs)	205	6711

a/ Based on NOEL = 0.5 mg/kg-day for human cholinergic signs (Nolan *et al.*, 1984)
b/ Based on a NOEL = 1.0 mg/kg-day for significant depression of brain cholinesterase activity from the chronic dog and rat studies (Young and Grandjean, 1988; McCollister *et al.*, 1971).

Chronic Exposure

The MOSs for potential chronic dietary risk associated with the annualized average daily dosage of chlorpyrifos for all population subgroups are greater than 2100 (Table 6). The highest exposed population subgroup, children 1 to 6 years of age, was estimated to have a MOS of 2198 from potential ingestion of 0.05% of the NOEL (1.00 mg/kg-day), based on depression of brain cholinesterase activity in both dog and rat studies. This potential chronic dietary exposure represents 15% of the USEPA RfD for chlorpyrifos. MOSs for other population subgroups are presented in Appendix D.

RISK APPRAISAL

The health risks from potential exposure to chlorpyrifos residues on foodstuffs were evaluated for the general population and various population subgroups. The MOSs for potential acute exposures were based on a NOEL of 0.5 mg/kg for cholinergic signs from a single-dose human study. Although there was substantial plasma cholinesterase inhibition at this dose, all of the studies on laboratory animals indicated extensive inhibition of both red blood cell as well as plasma cholinesterase occurs before there was any expression of cholinergic signs. Therefore the actual acute NOEL for cholinergic signs in humans may be greater than 0.5 mg/kg. The MOSs for chronic effects were based on brain cholinesterase activity depression (approximately 50%) from both a rat and a dog study. The lowest NOEL for this chronic effect was 1 mg/kg-day.

The dietary risk assessment addressed potential acute and chronic exposures for all populations and population subgroups from actual or hypothetical residues of chlorpyrifos in or on those commodities for which USEPA has established tolerances. MOSs for potential acute exposures in the general population were calculated to be greater than 50 at the 95th percentile of "user day" exposures for all population subgroups. A MOS of 10, which is based on a human NOEL, is adequate because it provides for variability in individual sensitivity to chlorpyrifos within the potentially exposed heterogenous population.

Exposure is another element in the risk characterization which determines an MOS. Estimates of potential dietary exposure to chlorpyrifos from residues on commodities were probably exaggerated. For the acute exposure estimates, each commodity was considered to have the highest measured residue level, which was very unlikely. It was also assumed that all label-approved crops were treated with chlorpyrifos, which was probably an overestimate. Further, the MOS values for potential dietary exposures were based on the assumptions that residues do not decrease between sampling and consumption due to degradation, washing, or cooking/processing, when in fact these activities may reduce residues substantially.

Surveillance residue levels are obtained by sampling composites of the RACs in the form in which they travel in the channels of commerce. Thus, residue values for chlorpyrifos in citrus were derived from the entire fruit, including the peel. Yet, it has been shown that even with over-tolerance levels of chlorpyrifos on the rinds of oranges, no detectable residues were present in the pulp (Iwata *et al*., 1983). No data were available for the other citrus commodities, but as citrus fruit and juice accounted for more than 50% of the estimated potential dietary exposure to chlorpyrifos on both an acute and chronic basis, the actual margins of safety are likely to be greater.

The MOSs for potential chronic exposures in all population subgroups were greater than 2100. These MOSs, based on long term toxic effects elicited in dietary studies involving rats (Young and Grandjean, 1988) and dogs (McCollister *et al.*, 1971), are considered adequate. Based on differences in the renal excretion, absorbance of chlorpyrifos by the human gut may be only 7/9 that of the rat (Nolan *et al*., 1984; Smith *et al.*, 1967). Consequently, the MOSs for potential chronic dietary exposure may be even greater than the calculated values.

TOLERANCE ASSESSMENT

BACKGROUND

A tolerance is the maximum, legal amount of a pesticide residue that is allowed on a raw or processed agricultural commodity, or in an animal tissue used for human consumption. The USEPA tolerance program was developed as an enforcement mechanism to identify illegal residue concentrations resulting from potential non-compliance with the product label requirements (e.g. improper application rates or methods, inadequate pre-harvest intervals, direct or indirect application to unapproved commodities). Tolerances are enforced by the FDA, USDA, and state enforcement agencies (e.g. Enforcement Branch of DPR)

Current tolerances for pesticides are generally set at levels that are not expected to produce deleterious health effects in humans from chronic dietary exposure. The data requirements for establishing a specific tolerance include: 1) toxicology data for the parent compound, major metabolites, degradation products and impurities, 2) product chemistry, 3) analytical method(s) that are readily available, accurate and precise, 4) measured residues in crops used for animal feeds, 5) measured residues in animal tissues (e.g. meat milk, eggs) from direct or indirect (feed) applications, 6) measured residue levels from field studies. The minimum requirements for the field study include: 1) an application rate at or above the highest rated on the product label, 2) the greatest number of allowable repeat applications, 3) the shortest pre-harvest interval listed on the product label. Generally, the registrant of the pesticide requests a commodity-specific tolerance, which is equal to the highest measured residue, or some multiple of that value, from the field trial using the specific pesticide.

Assembly Bill 2161 (Bronzan/Jones) requires the DPR to "conduct an assessment of dietary risks associated with the consumption of produce and processed food treated with pesticides". In the situation where "any pesticide use represents a dietary risk that is deleterious to the health of humans, the DPR shall prohibit or take action to modify that use or modify the tolerance....". As part of the tolerance assessment, a theoretical dietary exposure for a specific commodity and specific population subgroups can be calculated from the product of the tolerance and the daily consumption rate.

Acute Exposure: An acute exposure assessment using the residue level equal to the tolerance is conducted for each individual label-approved commodity. The TAS Exposure-4® software program and the USDA consumption data base are used in this assessment. The acute tolerance assessment does not routinely address multiple commodities at the tolerance levels, as the probability of consuming multiple commodities at the tolerance decreases as the number of commodities included in the assessment increases. Residue levels were set equal to the tolerance, and the MOS, based on a human NOEL for cholinergic signs and using the upper 95th percentile for user-day exposures for each population subgroup, was examined.

The tolerance for chlorpyrifos on apples may not provide an adequate margin of safety for potential acute dietary exposure of non-nursing infants, less than 1 year old (MOS=8; based on the 95th percentile of consumption with 150 user-days). The amount of chlorpyrifos in processed food forms of apples (apple juice, apple sauce, *etc*.) is likely to be substantially reduced from the amount found on an RAC (Iwata *et al*., 1983; Nelson and Tressler, 1980). As 36% of the apples consumed by non-nursing infants, less than 1 year of age, is in the form of apple juice, not the RAC, the MOS is probably greater. The tolerance for chlorpyrifos on apples provides an adequate margin of safety (MOS$\geq$11) for all other population subgroups. All other tolerances for chlorpyrifos on the most highly consumed commodities (21 CFR Part 101) provide adequate margins of safety (ranging from 11 to 28,839) for potential acute dietary exposure for all population subgroups (Table 7).

Chronic Exposure: A chronic exposure assessment using residues equal to the established tolerances for individual or combinations of commodities has not been conducted because it is highly improbable, if not impossible, that an individual would chronically consume single or multiple commodities with pesticide residues at the tolerance levels. Support for this conclusion comes from Department of

Pesticide Regulation pesticide monitoring programs which indicate that less than one percent of all sampled commodities have residue levels at or above the established tolerance (CDFA, 1990b).

TABLE 7 - MOS for potential acute dietary exposure to tolerance levels of chlorpyrifos residues for the most highly consumed commodities

Agricultural Commodity	Tolerance (ppm)	Margin of Safety (Range)
Apples	1.5	8 - 76
Asparagus	5.0	13 - 158
Bananas	0.05	693 - 5110
Beets, Sugar	1.0	311 - 1315
Blueberries	2.0	34 - 2630
Broccoli	2.0	26 - 104
Brussels Sprouts	2.0	61 - 357
Cabbage	2.0	26 - 156
Beef, and beef byproducts	2.0	35 - 92
Cherries	2.0	57 - 1710
Grapefruit	1.0	41 - 145
Kiwi	2.0	20 - 184
Lemons	1.0	300 - 28839
Milk	0.5	11 - 92
Onions, dry bulb	0.5	477 - 2656
Oranges	1.0	24 - 155
Peanuts	0.5	425 - 2045
Soybeans	0.5	146 - 1527
Strawberries	0.5	421 - 7919
Tomatoes	0.5	118 - 403
Turnips	3.0	39 - 143

CONCLUSION

Based on the currently available toxicity information, DPR concludes that both acute and chronic margins of safety for dietary exposure to potential chlorpyrifos residues on labelled use foodstuffs are considered adequate.

The tolerance for chlorpyrifos on apples provides adequate margins of safety (MOS≥11) for all population subgroups with the possible exception of non-nursing infants, less than the age of 1 (MOS=8). However, the tolerance is for whole apples. Yet, non-nursing infants consume apples predominantly as processed foods such as apple sauce or juice. Because residues of chlorpyrifos in processed apple products are likely to be substantially lower, the actual margin of safety, based on tolerance, is considered adequate. All other tolerances for chlorpyrifos on the most highly consumed commodities provide adequate margins of safety (ranging from 11 to 28,839) for potential acute dietary exposure for all population subgroups.

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APPENDIX A

Toxicology Summary

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF PESTICIDE REGULATION
MEDICAL TOXICOLOGY BRANCH

SUMMARY OF TOXICOLOGY DATA

CHLORPYRIFOS

SB 950-221, Tolerance # 00342
Summary initiated: 5/8/86
Revisions on 8/11/86, 11/24/86, 6/5/87, 4/25/89, 11/09/89, 3/16/90, 11/8/90, and 5/11/92

I. DATA GAP STATUS

Chronic rat:	No data gap, no adverse effect
Chronic dog:	No data gap, no adverse effect
Oncogenicity rat:	No data gap, no adverse effect
Oncogenicity mouse:	No data gap, no adverse effect
Reproduction rat:	No data gap, no adverse effect
Teratology rat:	No data gap, no adverse effect
Teratology mouse:	No data gap, no adverse effect
Gene mutation:	No data gap, no adverse effect
Chromosome effects:	No data gap, no adverse effect
DNA damage:	No data gap, possible adverse effect
Neurotoxicity:	No data gap, no adverse effect

Note, Toxicology one-liners are attached

All record numbers through 097570 (document 342-399) were examined, plus some older records with record numbers above 900000. This includes all relevant studies indexed as of 5/5/92.

In the one-liners below:
- ** indicates an acceptable study.
- **Bold face** indicates a possible adverse effect.
- ## indicates a study in progress.

File name: T920511
Updated by H. Green and C. Aldous, 5/11/92.

Note: these pages contain summaries only. Individual worksheets may identify additional effects.

II. TOXICOLOGY ONE-LINERS

COMBINED, RAT

** 345 072300 "Chlorpyrifos: 2-year dietary chronic toxicity-oncogenicity study in Fischer-344 rats". Dow Chemical Co., Freeport TX, 12/23/88. Chlorpyrifos ("AGR 214637"), 98.5%, in diet at 0, 0.05, 0.1, 1, and 10 mg/kg/day. 10/sex/dose designated for 1-year interim sacrifice: 50/sex/dose designated for 2-year duration. Cholinesterase (ChE) inhibition NOEL = 0.05 mg/kg/day (based on slight plasma ChE inhibition at 0.1 mg/kg/day in females). A ChE inhibition NOAEL of 0.1 mg/kg/day is nevertheless supportable, considering the issues discussed in the review for 354:074494. The NOEL for effects other than ChE inhibition was 0.1 mg/kg/day [based on very slight ($\leq$ 3%) but often statistically significant body weight decrease in 1 mg/kg/day males]. Body weights were statistically significantly reduced in 10 mg/kg/day males (7 to 9% throughout study). The "non-ChE effects" NOAEL was 1 mg/kg/day. Findings at 10 mg/kg/day were frequent perineal yellow staining in females, approximately 50% brain ChE inhibition in males and females, a slight increase in the degree of vacuolation of the adrenal zona fasciculata (males only), and a slight increase in diffuse retinal degeneration in 10 mg/kg/day females. None of these findings indicates possible adverse health effects (see review). ACCEPTABLE . C. Aldous, 4/21/89, 11/9/89 (see 354:074494).

342-354 074494 "Chlorpyrifos: 13-week dietary toxicity study in Fischer - 344 rats". Lake Jackson Research Center [The Dow Chemical Co.], Freeport, Texas, 12/28/88. This study was submitted by Dow to contest the CDFA decision of a cholinesterase (ChE) NOEL at 0.05 mg/kg/day in the 2-year study, 345:072300. No comprehensive CDFA review of this subchronic study is necessary at this time, since the purpose of the 13-week study was to set dose levels for the cited 2-year study, which has already been accepted by CDFA. This subchronic study found statistically reduced plasma ChE levels ($p < 0.05$, two tailed) at day 44, but not at day 91. Investigators concluded findings at day 44 "not considered to be of toxicologic or biologic significance." CDFA concludes that the findings are probably treatment effects, which however have no apparent toxicological consequence: the plasma ChE NOEL remains 0.05 mg/kg/day, but a practical NOAEL for ChE inhibition is 0.1 mg/kg/day. C. Aldous, 11/9/89.

342-363 087917 (supplemental information to 342-345:072300). "Macroscopic postmortem examination of the eyes and associated structures in albino rats (Dow Method)". (Refers to technique used at Freeport, TX, facility), method description dated 9/11/89. Methodology was presented in accordance with a CDFA request, which was made in the 4/21/89 CDFA review of the cited study. C. Aldous, 3/16/90.

250-251 036335-036337 "Results of Two-Year Dietary Feeding Studies on DOWCO 179 in Rats" Dow Chemical, Midland, Michigan, 9/20/71. Chlorpyrifos, (presumed technical); 0, 0.01, 0.03, 0.1, 1.0, and 3.0 mg/kg/day in diet. NOEL cholinesterase enzyme inhibition = 0.1 mg/kg/day. NOEL for other systemic effects = 3.0 mg/kg/day (HDT). No oncogenicity observed. Incomplete, UNACCEPTABLE, and not upgradeable Too few animals, too much attrition due to disease (largely chronic murine pneumonia) & dose levels not justified and apparently below the MTD. C. Aldous, 1/28/86.
EPA 1-liner: [2-year feeding, rat, Dow Chemical Co, 9/20/71] Systemic NOEL > 3.0 mg/kg/day (HDT); Cholinesterase NOEL = 0.1 mg/kg/day. Carcinogenic potential negative up to 3.0 mg/kg/day (HDT). Core grade, Supplementary.

044 031074 Published summary of 250/251:036335-036337.

013/053 031070 Summary of 250/251:036335-036337.

CHRONIC RAT
(See combined rat, above)

CHRONIC DOG

**252 036338-036339 "Results of Two-Year Dietary Feeding Studies on DOWCO* 179 in Beagle Dogs," Dow Chemical, Midland, MI, 12/10/71. Chlorpyrifos, (97.2% by glc); 0, 0.33, 1.0, 3.3, 33, and 100 ppm in feed. Cholinesterase inhibition NOEL = 1.0 ppm. NOEL for other effects, including behavioral observations, was the HDT = 100 ppm. ACCEPTABLE, no adverse effects: upgraded 3/16/90 on receipt of details on preparation of treated food. (Previous objections of CDFA to this study were (1) concerns that dosage range may not have adequately challenged the dogs, and (2) lack of reporting of ophthalmological examination data in the final report. These were addressed in submissions 306:063996 and 338:070883, respectively.) C. Aldous, 1/29/86, 4/11/89, and 3/16/90 (see also rebuttal response of 6/4/87 and minutes of meeting with Dow Chemical Co. representatives on 6/29/88).

342-363 087918 (Addendum to 342-252:036338, combined dog study). Submission contains mean body weights/sex and average food consumption for a 6-week period. At the end of the 6-week period, it was determined that 100 ppm in diet corresponded closely to 3.0 mg/kg/day in either sex. From that time on, diets were prepared at fixed levels of 100, 33, 3.3, 1.0, and 0.33 ppm by serial dilutions of diets. These data permit an upgrade of the 1971 dog study to ACCEPTABLE status. Aldous, 3/16/90.

273 056902 (Tab 3) EPA Office of Pesticide Programs, Toxicology Branch review of study 252:036338-036339. The review was submitted on Oct. 10, 1985 as OPP Toxicology Branch Document #004712. The review classified the study as "Core Minimum Data".

EPA 1-liner: [2-year feeding - dog; Dow Chem. Co.; 12/10/71] Systemic NOEL = > 3.0 mg/kg/day (HDT); Plasma ChE NOEL = 0.01 mg/kg/day; Plasma ChE LEL = 0.10 mg/kg; RBC AChE NOEL = 0.10 mg/kg/day; RBC ChE LEL = 1.0 mg/kg; Brain AChE NOEL = 1.0 mg/kg/day; Brain ChE LEL = 3 mg/kg; Core grade, supplementary [**NOTE UPGRADE TO "CORE MINIMUM" STATUS, INDICATED IN 273:042783**].

306:063996 "Results of 93-day dietary feeding studies of O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate in beagle hounds". This study was evaluated with respect to study 252:036338 in the 4/11/89 CDFA review.

338:070881-070882 are dietary analyses and analytical methods descriptions. These data were evaluated with respect to study 252:036338 in the 4/11/89 CDFA review.

338:070883 is a supplement to the original 2-year dog feeding study report. Supplement included ophthalmology data. These data had been submitted to EPA in 1985. These data were evaluated with respect to study 252:036338 in the 4/11/89 CDFA review.

044 031073 Published summary of 252:036338.

013/053 031070 Summaries of 252:036338-36339.

ONCOGENICITY, RAT
(See COMBINED, RAT section above)

ONCOGENICITY, MOUSE

**253 036340 "Results of a two-year toxicity and oncogenic study of Chlorpyrifos administered to CD-1 mice in the diet", Dow Chemical Toxicology Laboratory, Indianapolis, Indiana, 3/4/80. Chlorpyrifos, Ref. No. 1-500-2: 99.6% purity at 0, 0.5, 5.0, and 15.0 ppm in diet. NOEL = 15 ppm (no toxicity). No oncogenicity. ACCEPTABLE, based on re-reading of blood smears by S. D. Warner, D.V.M., Ph.D. (data in CDFA record 315:065762) answering a question by CDFA regarding possible effects on lymphocytes, (see 5/29/87 CDFA review). (Other concerns which CDFA had on this report were addressed in the 5/29/87 CDFA review). C. Aldous, 1/31/86, 5/29/87, 4/12/89.

273 042782 (Tab #4) Supplemental to 253:36340. "Chlorpyrifos: A Four - Week Dietary Study in CD-1 Mice," Dow Chemical, Midland, MI. Dietary administration of 0 or 15 ppm chlorpyrifos (95.7% purity) to CD-1 mice. 4 week study with body weights slightly reduced and plasma and serum cholinesterase levels statistically significantly reduced (see esp. Table 13). Meets minimal requirements for an "MTD" for dose level selection for an oncogenicity study (such as 253:036340, above). Examined 11/24/86 by C. Aldous. No written review required or performed.

EPA 1-liner: [2-Year oncogenic - mice; Dow Chemical Co.; 3/04/80]: Systemic and oncogenic NOEL > 15 ppm (HDT). Core grade, minimum.

290:050623 (Rebuttal/Additional data to 253:36340) "Results of a Two-Year Toxicity and Oncogenic Study of Chlorpyrifos Administered to CD-1 Mice in the Diet". Dow Chemical Toxicology Laboratory, 3/4/80. New information consists of individual data for blood smear exams, clinical observation and animal disposition, and gross and histopathology. Reviewer (Aldous) examined previously submitted chemical analyses of test material used in this and in one other study, and included evaluation in 5/29/87 review. No adverse effects noted. Study not acceptable, but possibly upgradeable. C. Aldous, 5/29/87.

013/053 031071 Summary only of 253:036340.

REPRODUCTION

RAT

**342-399 097570 "Chlorpyrifos: Two-generation dietary reproduction study in Sprague-Dawley rats", (W. J. Breslin, et al., The Toxicology Research Laboratory, Health and Environmental Sciences, The Dow Chemical Company, Midland, MI., Study ID: K-044793-088, 6/5/91). Chlorpyrifos, (technical grade Dursban F insecticide, AGR 273801), 98.5% purity, was fed in the diet to 30 Sprague-Dawley rats/sex/group through 2 generations with 1 litter per

generation. Concentrations were adjusted as needed to achieve exposures of 0, 0.1, 1.0, and 5.0 mg/kg/day. Treatment began approximately 10 and 12 weeks prior to breeding for the F0 and F1 adults, respectively. Cholinesterase inhibition NOEL = 0.1 mg/kg/day (Plasma and RBC ChE inhibition at 1.0 and 5.0 mg/kg/day). Parental NOEL = 1.0 mg/kg/day (increased degree of vacuolation in zona fasciculata, especially in males; altered tinctorial properties in this tissue in females). Reproductive NOEL = 1.0 mg/kg/day (slightly reduced pup weights and slightly reduced pup survival at 5.0 mg/kg/day). There were no clinical signs specifically indicating cholinesterase inhibition. The reproductive findings at 5 mg/kg/day do not warrant a "possible adverse effects" designation, since brain cholinesterase levels were very markedly depressed at that dose level, and all observed reproductive effects appeared to be due to failure of dams to nurture pups which were otherwise normal. **Acceptable**. (Green and Aldous, 5/11/92).

342-374 090493 Interim report for Record No. 097570, above.

254 036341 "Three Generation Reproduction and Teratology Study in the Rat Following Prolonged Dietary Exposure to Dursban, O,O-Diethyl O-3,5,6-Trichloro-2-Pyridyl Phosphorothioate," Dow Chemical, Zionsville, Indiana, 8/20/71. Chlorpyrifos, purity and grade not specified. Doses for the main portion of the reproduction study were 0, 0.1, 0.3, and 1.0 mg/kg/day in diet. Cholinesterase inhibition NOEL= 0.3 mg/kg/day. General adult toxicity NOEL = 1.0 mg/kg/day (HDT). Reproductive NOEL = 0.3 mg/kg/day (slightly increased pup mortality in first 5 days post-partum) UNACCEPTABLE, incomplete, not upgradeable (more definitive follow-up study is 254:036343). C. Aldous, 1/31/86.

EPA 1-liner: [3-Generation repro/terat - rat; Dow Chem. Co.; 8/20/71] Repro NOEL>1.0 mg/kg/day (HDT); Teratogenic NOEL = inconclusive. ChE NOEL=0.1 mg/kg Core grade, minimum

254 036343 "Dursban Insecticide: Assessment of Neonatal Survival In A Two-Generation Reproduction Study In Rats," Dow Chemical, Freeport, Texas, 7/83. Chlorpyrifos, technical; 0, 0.5, 0.8, and 1.2 mg/kg/day (dietary). Parental toxicity NOEL = reproductive toxicity NOEL = highest dose tested = 1.2 mg/kg/day. UNACCEPTABLE, incomplete, upgradeability unlikely (highest dose level not demonstrably toxic, and no justification offered for dosage selection). C. Aldous 2/7/86.

EPA 1-liner: [Two generation repro - rat; Dow Chem.: 7/83] Reproductive NOEL > 1.2 mg/kg/day (HDT); Systemic NOEL = 0.8 mg/kg; Systemic LEL= 1.2 mg/kg (decreased weight gain) Core grade, supplementary.

291: [No Record #, Tab = "Reproduction"] Rebuttal comments ref. rat reproduction studies 254:036341 and 254:036343. Registrant noted that CDFA should consider both reproduction studies together, considering additionally rat chronic data. Registrant suggested that plasma and RBC cholinesterase inhibition data support adequacy of dose. CDFA response: Doses are not justified in terms of parental toxicity, notwithstanding enzyme inhibition effects. Chronic studies are imperfect surrogate studies for evaluation of microscopic changes due to test article, since in chronic studies there is no evaluation of effects which carry over the generations. No change in status of studies. Reproductive effects study data requirement is not satisfied. C. Aldous, 6/2/87.

TERATOGENICITY

RAT

** 254 036344 "Chlorpyrifos: Oral Teratology Study in Fischer 344 Rats," Toxicology Research Lab., Dow Chemical USA, Midland, MI, 7/5/83. Chlorpyrifos, 96.6%. 0, 0.1, 3.0, and 15 mg/kg/day (gavage). Maternal NOEL (excluding cholinesterase (ChE) enzyme inhibition) = 3.0 mg/kg/day (cholinergic effects). Maternal ChE inhibition NOEL = 0.1 mg/kg/day (inhibition of plasma and RBC enzymes). Developmental toxicity NOEL = 15 mg/kg/day (Highest dose tested). ACCEPTABLE due to submission of supplementary information. See CDFA Rebuttal comments, C. Aldous, 6/1/87. (Study had been classified unacceptable in previous review by C. Aldous 2-10-86). C. Aldous, 6/1/87.

EPA 1-liner: [Teratology - rat; Tox. Research Lab; 7/5/83] Teratogenic and fetotoxic NOEL> 15 mg/kg/day (HDT); Maternal NOEL= 0.1 mg/kg; Maternal LEL= 3.0 (AChE inhibition) Core grade, minimum.

291 050624 (Rebuttal to primary study 254:036344). Considered in 6/1/87 review of primary study, 254:036344, above.

291 050625 (Pilot study to primary study 254:036344). "Chlorpyrifos: Oral teratology probe study in rats". Toxicology Research Lab, Dow, 1/4/83. Chlorpyrifos, 96.6%. 0, 3, 10, and 30 mg/kg/day by gavage in cottonseed oil. Study demonstrates that 30 mg/kg/day is severly toxic to dams: maternal deaths, typical cholinergic signs, high number of resorptions. Slightly matted haircoat and slight enlargement of adrenals were observed at 15 mg/kg/day. This pilot study clearly substantiates the adequacy of the dosage range selected for the primary study, 254:036344. C. Aldous, 6/1/87.

MOUSE

** 254 036345 "The Effects of Orally Administered Chlorpyrifos on Embryonal and Fetal Development in Mice," Dow Chemical, Toxicology Research Lab., Midland, MI, 7/24/79; Chlorpyrifos, presumed technical; 0, 0.1, 1, 10, and 25 mg/kg/day by gavage; NOEL for maternal functional toxicity = 1 mg/kg/day (cholinesterase effects as salivation, tremors, etc.). Cholinesterase enzyme NOEL = 0.1 mg/kg/day (significant inhibition of maternal plasma cholinesterase at 1 mg/kg/day). Developmental toxicity NOEL = 10 mg/kg/day (decreased fetal length and weight, delayed ossification in skull, sternebrae). ACCEPTABLE, in consideration of additional information in 291:050626 (See one-liner below). Report was previously not accepted (CDFA review 2/13/86, C. Aldous). C. Aldous, 6/1/87.

291 050626 (Addendum to 254:036345, primary mouse teratology study). Dow Chemical, Midland, MI, 7/24/79. New information provides grade of test article, dates of preparation of dose solutions, individual necropsy sheets for dams dying prior to term, and rationale for selection of mouse as test animal. C. Aldous, 6/1/87.

EPA 1-liner: Teratology - mice; Tox. Research Lab.; 7/24/74 [sic: presumed this is the 7/24/79 study]; Teratogenic NOEL > 25 mg/kg/day (HDT); fetotoxic NOEL = 10 mg/kg fetotoxic LEL = 25 mg/kg (decreased fetal length, increased skeletal variants); Plasma and RBC cholinesterase NOEL = 0.1 mg/kg/day.

013/053 031072 Summary of 254:036345 (see above).

GENE MUTATION

Bacteria:

255 036348 "Evaluation of Selected Pesticides As Chemical Mutagens, In Vitro and In Vivo Studies," (brief summary) SRI, 1977; Salmonella and E. coli. UNACCEPTABLE with no adverse effect reported. Salmonella, 4 strains (no TA98), were tested with and without activation at 0, 1, 5, 10, 50, 100, 500 and 1000 ug/plate and with Escherichia coli at the same concentrations. Chlorpyrifos, 98.8%. No evidence of a cytotoxic concentration or rationale for maximum concentration used. No repeat trial, no individual plate counts if more than one was made. Not upgradeable. J. Gee, 2/13/86.

273 042784 "Chlorpyrifos: Evaluation in the Ames' Salmonella/Mammalian-Microsome Mutagenicity Assay," Dow Chemical, Freeport, Texas, 1986; Salmonella. Chlorpyrifos (95.7%) tested in strains TA1535, TA1537, TA98 and TA100 at 0, 1, 3.16, 10, 31.6 and 100 ug/plate; with and without rat liver activation; 30 min preincubation before plating, triplicate plates, one trial, no evidence for increased reversion rate. UNACCEPTABLE. Report states that a precipitate formed at 100 ug/plate. The earlier study did not mention this. J. Gee, 7/30/86.

Mammalian cells:

255 036351 "Evaluation of Chlorpyrifos in the Chinese Hamster Ovary Cell-Hypoxanthine (Guanine) Phosphoribosyl Transferase (CHO/HGPRT) Forward Mutation Assay," Dow Chemical, Midland, MI, 1985; UNACCEPTABLE with no adverse effect reported in CHO cells. Chlorpyrifos, 95.7%, at 0, 10, 20, 25, 30, 40 or 50 uM with and without activation for 4 hours, with no increase in mutation frequency reported in a single trial. A precipitate formed at 30 uM and above. Major problem: no confirming trial. Not upgradeable. J. Gee, 2/13/86.

291 [No Record No., second "Mutagenicity" tab in volume]. Rebuttal comments ref 255:036351. CDFA conclusion was study still UNACCEPTABLE: major concern remaining is lack of a confirmatory test for a negative result. (J. Gee, 6/5/87).

291 057665 A table entitled "Analytical determination of stability of Chlorpyrifos in DMSO" in support of 255:036351, above. (Submitted as part of rebuttal document of 12/1/86).

***SUMMARY: The 1977 SRI study (#036348), using four strains of Salmonella (but not TA98) at 0 to 1000 ug/plate, was negative for increased reversion. Also, the CHO/HGPRT study on file showed negative results. EPA accepted this CHO study (#036351) although CDFA review found it unacceptable because there was no repeat. Considering all of these studies, with no one alone being acceptable, and that #042784 is a repeat of #036348 -- the deficiency for which each was rejected separately -- the 842 data gap is considered filled.

CHROMOSOME EFFECTS

NOTE: Only one dose was used in the most recent study (363:087919), so this study is not independently acceptable. This study can be considered along with the previous micronucleus study (Record 036350), which was conducted in the same strain of mouse in 1985, and which used chlorpyrifos of a similar purity. There was an effect on body weights at 90 mg/kg body weight in study 363:087919, confirming adequacy of dose. Since an acceptable range of doses is provided in the two studies, the collective data from the two studies satisfy data requirements on effects on chromosomes.

363 087919 "Evaluation of Chlorpyrifos in the Bone Marrow Micronucleus Test." (Dow, TXT: K-044793-067A, 9/22/89) Chlorpyrifos, lot AGR 214637, 97.9%; tested with CD-1 (ICR) BR mice, with sacrifices of 5/sex/group at 24, 48 or 72 hours after a single oral gavage dosing of 0 (corn oil) or 90 mg/kg b. wt. stated to be 80% of the LD_{50}; cyclophosphamide as positive control; no mortalities but decrease in body weights in the treatment groups; no evidence of micronuclei formation and no clear effect on PCE/NCE. UNACCEPTABLE (only one dose level). (Gee, 3/12/90)

255 036350 "Evaluation of Chlorpyrifos in the Mouse Bone Marrow Micronucleus Test," Dow Chemical, Freeport, Texas, 1985; Mouse micronucleus test. UNACCEPTABLE with no adverse effect. Chlorpyrifos, 95.7%, was given by oral gavage to 5/sex/group at 0, 7, 22, or 70 mg/kg with sacrifices at 24 and 48 hours. No statistically significant increase in micronuclei in PCE's is reported; % PCE marginally effected in females only at 48 hours being 63 as compared with 76 for the vehicle control. This is suggestive that a higher dose and/or a longer sampling time should have been included even at the risk of losing some of the animals. In the Appendix data show that survival at 100 mg/kg would be adequate for the assay. Also, no clinical signs were observed. The high dose reportedly was based on 60% of the LD50 of approximately 111 mg/kg. Guidelines and the meaningfulness of the test call for some signs than a toxic dose was reached, either the MTD for the animal or cytotoxicity to the bone marrow. The only death was in female vehicle control. No data on micronucleated normochromatic erythrocytes is included. Because positive effects have been reported in gene conversion and DNA repair, an adequate test in this test area is needed. Not upgradeable. J. Gee, 2/13/86.
NOTE: EPA considers this study as acceptable, according to the EPA response to CDFA data gap status issues on chlorpyrifos, dated 1/17/89. Aldous, 12/4/89.

291 [No Record number, first "Mutagenicity" tab in volume]. Rebuttal comments ref 255:036350. CDFA conclusion was study still UNACCEPTABLE: major concerns remaining are inadequate justification of treatment levels, and lack of a 72 hr sacrifice time. J. Gee, 6/5/87.

DNA DAMAGE

255 036349 "Evaluation of Selected Pesticides As Chemical Mutagens, In Vitro and In Vivo Studies --Mammalian In Vitro Unscheduled DNA Synthesis Assays," SRI, 1977; UDS in WI-38. UNACCEPTABLE but upgradeable with no adverse effect reported. Chlorpyrifos, 98.8%. WI-38, human embryonic lung fibroblasts, were exposed with and without activation (rat liver) to 0, 10^{-7}, 10^{-6}, 10^{-5}, 10^{-4}, and 10^{-3} with six cultures -S9 and 3 +S9. DPM/ug DNA is reported with no change in the DPM with increasing concentrations. DNA was extracted from the cells by a standard method and an aliquot used to determine the amount of DNA and another portion used to determine the incorporation of tritiated thymidine by liquid scintillation counting as a measure of DNA repair in response to damage by the test article. Missing information on how the CPM were converted to DPM, the quantity of DNA recovered per culture, the passage number of the WI-38, and the rationale for the selection of the concentrations used - whether solubility or cytotoxicity. CDFA review 2-13-86 J. Gee.

255 036347 "Evaluation of Selected Pesticides As Chemical Mutagens, In Vitro and In Vivo Studies --Microbiological Assays" (summary report), SRI, 1977; Saccharomyces cerevisiae D_3. UNACCEPTABLE with a positive effect reported. Mitotic recombination-gene conversion in yeast exposed to a 5% concentration for 4 hours, with and without metabolic activation. The test was repeated. No individual data. Because of the lack of data, the significance of the effect cannot be evaluated but the possible genotoxic effect must be noted. Upgradeable. J. Gee, 2/13/86.

255 042609 "Evaluation of Selected Pesticides As Chemical Mutagens, In Vitro and In Vivo Studies -Microbiological Assays" (summary), SRI, 1977; Escherichia coli and Bacillus subtilis. UNACCEPTABLE with a positive adverse effect reported. Chlorpyrifos, 98.8% purity, at 2.5 ug/disc, was tested with E. coli W3110 and p3478 and with B. subtilis H17 and M45. No activation was included and the test reportedly was repeated 3 times. The comparable zones of inhibition between the strains indicated a larger zone for the repair defective strains. Only one value for each strain is reported. If the full report were submitted, it is possible that the effect could be evaluated for significance. Since no activation was included, the study is not upgradeable. J. Gee, 2/13/86.

** 273 042785 "Evaluation of Chlorpyrifos in the Rat Hepatocyte Unscheduled DNA Synthesis (UDS) Assay," Dow Chemical, Midland, MI, 1986; Chlorpyrifos (95.7%); primary rat hepatocytes tested for unscheduled DNA synthesis at 10^{-6}, 3.13 x10^{-6}, x 10^{-5}, 3.16 x 10^{-5} and 1 x 10^{-4} M; triplicate cultures in a single trial; no evidence of UDS; toxicity at the highest concentration. Acceptable. J. Gee, 7/30/86.

SUMMARY: The positive findings in the two microbial studies are somewhat related. The B. subtilis test compares the response of rec^- (recombination defective) with wild type organisms. The rec^- strain is not as competent to repair damage and hence shows a greater inhibition of growth from lethality due to DNA damage. The test in Saccharomyces also measures recombination-type events in competent organisms and the increase in these events confirms the DNA damage. The complete versions of these two reports are needed to assess their significance. The two tests in mammalian cells measure a different repair event (excision repair) with repair replication occurring to fill the DNA gap following removal of damaged bases by excision using different enzymes. Although the data gap for 844 is filled, the positive findings in the microbial tests cannot be dismissed without more information about the bacterial studies.

NEUROTOXICITY

**291 051119 "Chlorpyrifos: Subchronic Organophosphate-Induced Delayed-Neurotoxicity (OPIDN) Study In Laying Chicken Hens," (Report No. TXT:K-044793-064), Health & Environmental Sciences, Dow Chemical, Freeport, Texas, 4/86. Chlorpyrifos, tech. (approx. 96% purity). 0, 1, 5, and 10 mg/kg/day. No evidence of delayed distal neuropathy. 10 mg/kg/day chlorpyrifos caused weight loss, diminished egg laying capacity, and transient abnormal gait (fully reversible between dosing periods, and not persistent throughout study). Study fills neurotoxicity data requirement. C. Aldous, 6/3/87.

255 036346 "Acute Delayed Neurotoxicologic Evaluation of Chlorpyrifos in White Leghorn Hens," Dow Chemical, Lake Jackson, Texas, 5/22/78; Chlorpyrifos, tech; 0, 50, and 100 mg/kg (gelatin capsule); NOEL = 100 mg/kg for behavioral or microscopically evident delayed neuropathy (Highest dose tested) NOT ACCEPTABLE, not complete, not upgradeable (no repeat dosage at day 21 when no effects were observed, not all currently required tissues examined.) C. Aldous, 2/13/86.

EPA 1-liner: [Acute delayed neurotoxicity - hen; Dow; 5/22/78] LD50 in hens= 50 mg/kg Negative @ 50 & 100 mg/kg. Core grade, minimum.

APPENDIX B

USEPA Tolerances for Chlorpyrifos

CHLORPYRIFOS (INSECTICIDE)

DURSBAN™
LORSBAN™

O,O DIETHYL O-(3,5,6-TRICHLORO-2-PYRIDYL) PHOSPHOROTHIOATE
AND METABOLITE: 3,5,6-TRICHLORO-2-PYRIDINOL
40 CFR 180.342; 180.3(e)(5); 185.1000; 186.1000

PPM	CROP
4.0	Alfalfa, Green Forage
15.0	Alfalfa, Hay
0.2	Almonds
12.0	Almonds, Hulls
12.0 FA	Apple Pomace, Dried
1.5	Apples
5.0(R)	Asparagus (Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oregon, South Dakota, Washington)
0.05	Banana Pulp
0.25	Bananas
1.0	Beans, Forage
0.05	Beans, Lima
1.0	Beans, Lima, Forage
0.05	Beans, Snap
1.0	Beans, Snap, Forage
3.0 FA	Beets, Sugar, By-Products (Molasses)
15.0 FA	Beets, Sugar, Molasses
5.0 FA	Beets, Sugar, Pulp, Dried
1.0	Beets, Sugar, Roots
8.0	Beets, Sugar, Tops
2.0	Blueberries (of which NMT 1 ppm is chlorpyrifos)
1.0	Caneberries
2.0	Cattle, Fat
2.0	Cattle, MBYP
2.0	Cattle, Meat
0.05(R)	Cherimoya (California)
2.0	Cherries
1.0	Citrus Fruit
5.0 FA	Citrus Pulp, Dried
25.0 FA	Citrus Oil
10.0	Corn, Fodder
10.0	Corn, Forage
0.1	Corn, Fresh (Incl. Sweet Corn K+CWHR)
0.1	Corn, Grain, Field
3.0 FA	Corn, Oil
1.0 FA	Corn, Soapstock
0.5	Cottonseed
1.0	Cranberries
0.1	Cucumbers
0.5(R)	Dates (of which NMT 0.3 ppm is chlorpyrifos) California
0.1	Eggs
0.05(R)	Feijoa (Pineapple Guava) California
0.1	Figs
FA	Food Handling Establishments
1.0	Goats, Fat
1.0	Goats, MBYP
1.0	Goats, Meat
2.0 FA	Grape Pomace, Dried
0.5(R)	Grapes (East of Rocky Mountains)
0.5	Hogs, Fat
0.5	Hogs, MBYP
0.5	Hogs, Meat
1.0	Horses, Fat
1.0	Horses, MBYP
1.0	Horses, Meat
2.0	Kiwi Fruit
0.5(R)	Leeks (of which NMT 0.2 ppm is chlorpyrifos) New Jersey
0.1	Legume Vegetables, Succulent or Dried (Except Soybeans)
2.5(T)	Lemons Exp. 6/30/83
0.5(N)	Milk, Fat (Reflecting 0.02 ppm in whole milk)
1.0	Mint Hay
10.0 FA	Mint Oil
0.1	Mushrooms
0.05	Nectarines
0.2	Nuts (Tree)
0.5	Onions, Dry Bulb
2.5(T)	Oranges Exp. 6/30/83
0.05	Peaches
0.5	Peanuts
15.0	Peanuts, Hulls
1.5FA	Peanuts, Oil
0.05	Pears
1.0	Peas, Forage
1.0	Peppers
0.05	Plums (Fresh Prunes)
0.5	Poultry, Fat (Incl. Turkeys)
0.5	Poultry, MBYP (Incl. Turkeys)
0.5	Poultry, Meat (Incl. Turkeys)
0.1	Pumpkins
3.0	Radishes
3.0	Rutabagas
0.05(R)	Sapote (California)
0.1	Seed & Pod Vegetables
1.0	Sheep, Fat
1.0	Sheep, MBYP
1.0	Sheep, Meat
6.0	Sorghum, Fodder
1.5	Sorghum, Forage
0.75	Sorghum, Grain
1.5FA	Sorghum, Grain, Milling Fractions
0.5	Soybeans
8.0	Soybeans, Forage
15.0	Soybeans, Straw
0.5	Strawberries
0.25	Sunflower Seeds
0.5FA	Sunflower Seeds, Hulls
0.1	Sweet Potatoes
0.5	Tomatoes
1.0	Turnips, Green
3.0	Turnips, Roots
2.0	Vegetables, Leafy, Brassica (Cole) (of which NMT 1 ppm is chlorpyrifos)
1.0(T)	Wheat Exp. 10/27/82
0.2	Walnuts

Administrative Guidelines: None

Tolerances Pending:

PPM	CROP
4	Alfalfa, Green Forage (of which NMT 3 ppm is chlorpyrifos) 6/22/83
15	Alflafa, Hay (of which NMT 13 ppm is chlorpyrifos) 2/8/84
0.05	Apricots (of which NMT 0.01 ppm is chlorpyrifos) 3/19/86
0.05	Bananas, Pulp with Peel Removed (of which NMT 0.01 ppm is chlorpyrifos) 6/22/83
1	Beans, Forage (of which NMT 0.7 ppm is chlorpyrifos) 6/22/83
2	Cattle, Meat (Fat Basis) 9/22/82
2.5	Cattle (Meat, Fat, MBYP) (of which NMT 2 ppm is chlorpyrifos) 2/8/84
2	Cherries (of which NMT 1 ppm is chlorpyrifos) 6/22/83
10	Corn, Fodder & Forage (of which NMT 3 ppm is chlorpyrifos) 6/22/83
0.1	Corn, Fresh (Incl. Sweet Corn K+CWHR) (of which NMT 0.05 ppm is chlorpyrifos) 6/22/83
0.1	Corn, Grain, Field (of which NMT 0.05 ppm is chlorpyrifos) 6/22/83
3 FA	Corn, Oil (of which NMT 1.5 ppm is chlorpyrifos) 6/22/83
1 FA	Corn, Soapstock (of which NMT 0.5 ppm is chlorpyrifos) 6/22/83
0.5	Cottonseed (of which NMT 0.2 ppm is chlorpyrifos) 6/22/83
0.1	Cucumbers (of which NMT 0.05 ppm is chlorpyrifos) 6/22/83
0.1	Eggs (of which NMT 0.01 ppm is chlorpyrifos) 6/22/83
0.1	Figs (of which NMT 0.01 ppm is chlorpyrifos) 6/22/83

CONTINUED ON PAGE 111

(N) = Negligible Residue Tolerance
(T) = Temporary Tolerance
(R) = Regional Tolerance
FA = Food Additive Tolerance

CHLORPYRIFOS, CONTD.

Tolerances Pending, contd.:

PPM	CROP
0.1 FA	Food Items (All not covered by a higher tolerance as a result of use on growing corps) in food preparation and service establishments 12/24/91
1.5	Fruiting Vegetables (Except Cucurbits) (of which NMT 1 ppm is chlorpyrifos) 9/25/85
2	Goats (Meat, Fat, MBYP) (of which NMT 1.0 ppm is chlorpyrifos) 2/8/84
3 FA	Grape Pomace (of which NMT 2.5 ppm is chlorpyrifos) 6/22/83
1	Grapes (of which NMT 0.8 ppm is chlorpyrifos) 6/22/84
0.5	Hogs (Meat, Fat, MBYP) (of which NMT 0.3 ppm is chlorpyrifos) 2/8/84
1.5	Horses (Meat, Fat, MBYP) (of which NMT 0.3 ppm is chlorpyrifos) 2/8/84
2	Lettuce (of which NMT 1 ppm is chlorpyrifos) 12/15/84
0.5	Milk Fat (of which NMT 0.25 ppm is chlorpyrifos) 6/22/83; 2/8/84
0.03	Milk, Whole (of which NMT 0.02 ppm is chlorpyrifos) 2/8/84
1	Mint Hay (of which NMT 0.3 ppm is chlorpyrifos) 2/8/84
10 FA	Mint Oil (of which NMT 8 ppm is chlorpyrifos) 6/22/83
0.05	Nectarines (of which NMT 0.01 ppm is chlorpyrifos) 6/22/83
0.5	Nectarines 3/19/86
0.05	Peaches (of which NMT 0.01 ppm is chlorpyrifos) 6/22/83
1	Pea Forage (of which NMT 0.7 ppm is chlorpyrifos) 6/22/83
15	Peanut Hulls (of which NMT 2 ppm is chlorpyrifos) 6/22/83
1.5FA	Peanut Oil (of which NMT 0.4 ppm is chlorpyrifos) 6/22/83
0.5	Peanuts (of which NMT 0.2 ppm is chlorpyrifos) 6/22/83
0.05	Pears (of which NMT 0.01 ppm is chlorpyrifos) 6/22/83
1	Pears (of which NMT 0.5 ppm is chlorpyrifos) 3/19/86
0.05	Plums (Fresh Prunes)(of which NMT 0.01 ppm is chlorpyrifos) 6/22/83
0.2	Plums (Incl. Fresh Prunes) 3/19/86
0.5	Poultry, MBYP (Incl. Turkeys)(of which NMT 0.01 ppm is chlorpyrifos) 2/8/84
0.1	Pumpkins (of which NMT 0.05 ppm is chlorpyrifos) 6/22/83
3	Radishes (of which NMT 2 ppm is chlorpyrifos) 6/22/83
0.2FA	Raisins 6/22/83
0.8FA	Raisin Waste (of which NMT 0.5 ppm is chlorpyrifos) 6/22/83
3	Rutabagas (of which NMT 0.5 ppm is chlorpyrifos) 6/22/83
2	Sheep (Meat, Fat, MBYP) (of which NMT 1.0 ppm is chlorpyrifos) 2/8/84
6	Sorghum Fodder (of which NMT 4.0 ppm is chlorpyrifos) 2/8/84
1.5	Sorghum Forage (of which NMT 1.0 ppm is chlorpyrifos) 2/8/84
0.75	Sorghum Grain (of which NMT 0.3 ppm is chlorpyrifos) 6/22/83
1.5FA	Sorghum Grain, Milling Fractions (of which NMT 0.8 ppm is chlorpyrifos) 2/8/84
0.5	Soybeans (of which NMT 0.3 ppm is chlorpyrifos) 6/22/83
3	Stone Fruits (of which NMT 2 ppm is chlorpyrifos) 6/23/84
0.5	Strawberries (of which NMT 0.2 ppm is chlorpyrifos) 6/22/83
5 FA	Sugar Beets, Pulp, Dried (of which NMT 0.5 ppm is chlorpyrifos) 6/22/83
15 FA	Sugar Beets, Molasses (of which NMT 0.01 ppm is chlorpyrifos) 6/22/83
0.25	Sunflower Seeds (of which NMT 0.2 ppm is chlorpyrifos) 6/22/83
0.5FA	Sunflower Seeds, Hulls (of which NMT 0.4 ppm is chlorpyrifos) 6/22/83
0.1	Sweet Potatoes (of which NMT 0.05 ppm is chlorpyrifos) 6/22/83
100 FA	Tomato Pomace (of which NMT 65.0 ppm is chlorpyrifos in animal feed) 2/8/84
1.5	Tomatoes (of which NMT 1 ppm is chlorpyrifos) 2/8/84
1	Turnip Greens (of which NMT 0.3 ppm is chlorpyrifos) 6/22/83
3	Turnips (of which NMT 1 ppm is chlorpyrifos) 6/22/83
3	Wheat, Forage (of which NMT 2.5 ppm is chlorpyrifos) 9/29/83
0.6	Wheat, Grain (of which NMT 0.3 ppm is chlorpyrifos) 9/29/83
2 FA	Wheat, Milling Fractions (of which NMT 1 ppm is chlorpyrifos) 2/8/84
6	Wheat, Straw (of which NMT 4 ppm is chlorpyrifos) 9/29/83

PROPOSED REMOVED 5/29/85:

PPM	CROP
2	Broccoli
2	Brussels Sprouts
2	Cabbage
2	Cabbage, Chinese
2	Cauliflower

(N) = Negligible Residue Tolerance
(T) = Temporary Tolerance
(R) = Regional Tolerance
FA = Food Additive Tolerance

APPENDIX C

Acute Dietary Exposure Analysis

and

Residue File

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
DATE RESIDUE FILE CREATED OR LAST UPDATED: 10-05-1991/09:55:43
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, some tolerances, and a field study
COMMENT 2: All label approved direct food uses and secondary residues

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
7	01009AA	N	BLUEBERRIES			CDFA
	11		Raw	0.050000	1.00	
	13		Baked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	33		Canned: Baked	0.050000	1.00	
	41		Frozen: Raw	0.050000	1.00	
	43		Frozen: Baked	0.050000	1.00	
8	01010AA	N	CRANBERRIES			FDA
	11		Raw	0.900000	1.00	
	32		Canned: Cooked	0.900000	1.00	
	42		Frozen: Cooked	0.900000	1.00	
13	01014AA	N	GRAPES			FDA
	11		Raw	0.250000	1.00	
	32		Canned: Cooked	0.250000	1.00	
	41		Frozen: Raw	0.250000	1.00	
14	01014DA	N	GRAPES-RAISINS			CDFA
	11		Raw	0.110000	1.00	
	12		Cooked	0.110000	1.00	
	13		Baked	0.110000	1.00	
	18		Raw: Dried	0.110000	1.00	
	19		Cooked: Dried	0.110000	1.00	
	42		Frozen: Cooked	0.110000	1.00	
17	01016AA	N	STRAWBERRIES			CDFA
	11		Raw	0.200000	1.00	
	12		Cooked	0.200000	1.00	
	13		Baked	0.200000	1.00	
	32		Canned: Cooked	0.200000	1.00	
	33		Canned: Baked	0.200000	1.00	
	35		Canned: Fried	0.200000	1.00	
	41		Frozen: Raw	0.200000	1.00	
	43		Frozen: Baked	0.200000	1.00	
22	02002AB	K	GRAPEFRUIT-PEELED FRUIT			CDFA
	11		Raw	0.250000	1.00	
	41		Frozen: Raw	0.250000	1.00	
23	02002JA	K	GRAPEFRUIT-JUICE			CDFA
	11		Raw	0.250000	2.10	
	32		Canned: Cooked	0.250000	2.10	
24	02003AA	K	KUMQUATS			FDA
	11		Raw	0.060000	1.00	
	32		Canned: Cooked	0.060000	1.00	
26	02004AB	K	LEMONS-PEELED FRUIT			CDFA
	11		Raw	0.390000	1.00	
	13		Baked	0.390000	1.00	
	32		Canned: Cooked	0.390000	1.00	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
27	02004HA	K	LEMONS-PEEL			CDFA
	11		Raw	0.390000	1.00	
	12		Cooked	0.390000	1.00	
	13		Baked	0.390000	1.00	
	15		Fried	0.390000	1.00	
28	02004JA	K	LEMONS-JUICE			CDFA
	11		Raw	0.390000	2.00	
	12		Cooked	0.390000	2.00	
	13		Baked	0.390000	2.00	
	15		Fried	0.390000	2.00	
	32		Canned: Cooked	0.390000	2.00	
	33		Canned: Baked	0.390000	2.00	
	41		Frozen: Raw	0.390000	2.00	
	42		Frozen: Cooked	0.390000	2.00	
30	02005AB	K	LIMES-PEELED FRUIT			CDFA
	11		Raw	0.060000	1.00	
31	02005HA	K	LIMES-PEEL			CDFA
	12		Cooked	0.060000	1.00	
	13		Baked	0.060000	1.00	
32	02005JA	K	LIMES-JUICE			CDFA
	11		Raw	0.060000	2.00	
	32		Canned: Cooked	0.060000	2.00	
	41		Frozen: Raw	0.060000	2.00	
33	02006JC	K	ORANGES-JUICE-CONCENTRATE			FS
	12		Cooked	0.030000	6.70	
	32		Canned: Cooked	0.030000	6.70	
	41		Frozen: Raw	0.030000	6.70	
	42		Frozen: Cooked	0.030000	6.70	
34	02006AB	K	ORANGES-PEELED FRUIT			FS
	11		Raw	0.030000	1.00	
	18		Raw: Dried	0.030000	1.00	
	32		Canned: Cooked	0.030000	1.00	
	38		Canned: Raw/Dried	0.030000	1.00	
	41		Frozen: Raw	0.030000	1.00	
35	02006HA	K	ORANGES-PEEL			CDFA
	11		Raw	1.000000	1.00	
	12		Cooked	1.000000	1.00	
	13		Baked	1.000000	1.00	
	18		Raw: Dried	1.000000	1.00	
	32		Canned: Cooked	1.000000	1.00	
36	02006JA	K	ORANGES-JUICE			FS
	11		Raw	0.030000	1.80	
	13		Baked	0.030000	1.80	
	32		Canned: Cooked	0.030000	1.80	
	41		Frozen: Raw	0.030000	1.80	
38	02008AA	K	TANGERINES			FDA
	11		Raw	0.410000	1.00	
	41		Frozen: Raw	0.410000	1.00	
39	02008JA	K	TANGERINES-JUICE			FDA
	32		Canned: Cooked	0.410000	2.30	
	41		Frozen: Raw	0.410000	2.30	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
40	03001AA	R	ALMONDS			CDFA
	11		Raw	0.200000	1.00	
	12		Cooked	0.200000	1.00	
	13		Baked	0.200000	1.00	
	14		Boiled	0.200000	1.00	
	15		Fried	0.200000	1.00	
	18		Raw: Dried	0.200000	1.00	
	19		Cooked: Dried	0.200000	1.00	
	43		Frozen: Baked	0.200000	1.00	
	44		Frozen: Boiled	0.200000	1.00	
41	03002AA	R	BRAZIL NUTS			CDFA
	13		Baked	0.050000	1.00	
	15		Fried	0.050000	1.00	
	18		Raw: Dried	0.050000	1.00	
42	03003AA	R	CASHEWS			Tolerance
	11		Raw	0.200000	1.00	
	13		Baked	0.200000	1.00	
	15		Fried	0.200000	1.00	
	18		Raw: Dried	0.200000	1.00	
	43		Frozen: Baked	0.200000	1.00	
43	03004AA	R	CHESTNUTS			CDFA
	13		Baked	0.050000	1.00	
44	03005AA	R	FILBERTS (HAZELNUTS)			Tolerance
	13		Baked	0.200000	1.00	
	15		Fried	0.200000	1.00	
	18		Raw: Dried	0.200000	1.00	
46	03007AA	R	MACADAMIA NUTS (BUSH NUTS)			Tolerance
	13		Baked	0.200000	1.00	
	18		Raw: Dried	0.200000	1.00	
47	03008AA	R	PECANS			CDFA
	11		Raw	0.050000	1.00	
	13		Baked	0.050000	1.00	
	15		Fried	0.050000	1.00	
	18		Raw: Dried	0.050000	1.00	
	43		Frozen: Baked	0.050000	1.00	
48	03009AA	R	WALNUTS			CDFA
	11		Raw	0.200000	1.00	
	12		Cooked	0.200000	1.00	
	13		Baked	0.200000	1.00	
	18		Raw: Dried	0.200000	1.00	
	48		Frozen: Dried-Raw	0.200000	1.00	
52	04001AA	L	APPLES			CDFA
	11		Raw	0.650000	1.00	
	12		Cooked	0.650000	1.00	
	13		Baked	0.650000	1.00	
	15		Fried	0.650000	1.00	
	32		Canned: Cooked	0.650000	1.00	
	33		Canned: Baked	0.650000	1.00	
	34		Canned: Boiled	0.650000	1.00	
	42		Frozen: Cooked	0.650000	1.00	
	44		Frozen: Boiled	0.650000	1.00	

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
56	04003AA	L	PEARS			FDA
	11		Raw	0.010000	1.00	
	12		Cooked	0.010000	1.00	
	13		Baked	0.010000	1.00	
	15		Fried	0.010000	1.00	
	32		Canned: Cooked	0.010000	1.00	
58	04004AA	L	QUINCES			CDFA
	11		Raw	0.250000	1.00	
59	05001AA	M	APRICOTS			CDFA
	11		Raw	0.030000	1.00	
	12		Cooked	0.030000	1.00	
	32		Canned: Cooked	0.030000	1.00	
	33		Canned: Baked	0.030000	1.00	
	35		Canned: Fried	0.030000	1.00	
61	05002AA	M	CHERRIES			CDFA
	11		Raw	0.210000	1.00	
	12		Cooked	0.210000	1.00	
	13		Baked	0.210000	1.00	
	32		Canned: Cooked	0.210000	1.00	
	33		Canned: Baked	0.210000	1.00	
	35		Canned: Fried	0.210000	1.00	
	41		Frozen: Raw	0.210000	1.00	
	42		Frozen: Cooked	0.210000	1.00	
64	05003AA	M	NECTARINES			FDA
	11		Raw	0.210000	1.00	
	12		Cooked	0.210000	1.00	
65	05004AA	M	PEACHES			CDFA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	13		Baked	0.050000	1.00	
	15		Fried	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	33		Canned: Baked	0.050000	1.00	
	35		Canned: Fried	0.050000	1.00	
	41		Frozen: Raw	0.050000	1.00	
67	05005AA	M	PLUMS(DAMSONS)			CDFA
	11		Raw	0.530000	1.00	
	32		Canned: Cooked	0.530000	1.00	
	33		Canned: Baked	0.530000	1.00	
68	05005DA	M	PLUMS-PRUNES(DRIED)			CDFA
	14		Boiled	0.240000	1.00	
	18		Raw: Dried	0.240000	1.00	
	19		Cooked: Dried	0.240000	1.00	
	32		Canned: Cooked	0.240000	1.00	
72	06002AB	A	BANANAS			CDFA
	11		Raw	0.050000	1.00	
	13		Baked	0.050000	1.00	
	15		Fried	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	41		Frozen: Raw	0.050000	1.00	
77	06004AA	A	DATES			CDFA
	11		Raw	0.050000	1.00	
	13		Baked	0.050000	1.00	

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
78	06005AA	A	FIGS			CDFA
	11		Raw	0.100000	1.00	
	13		Baked	0.100000	1.00	
	18		Raw: Dried	0.100000	1.00	
	19		Cooked: Dried	0.100000	1.00	
	32		Canned: Cooked	0.100000	1.00	
97	06018AA	A	KIWI FRUIT			CDFA
	11		Raw	0.230000	1.00	
148	10010AA	J	CUCUMBERS			CDFA
	11		Raw	0.100000	1.00	
	12		Cooked	0.100000	1.00	
	32		Canned: Cooked	0.100000	1.00	
	51		Smoked/Cured/Salted/Raw	0.100000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.100000	1.00	
149	10011AA	J	PUMPKIN			CDFA
	11		Raw	0.100000	1.00	
	12		Cooked	0.100000	1.00	
	14		Boiled	0.100000	1.00	
	32		Canned: Cooked	0.100000	1.00	
	33		Canned: Baked	0.100000	1.00	
155	11003AA	I	PEPPERS-SWEET(GARDEN)			CDFA
	11		Raw	0.580000	1.00	
	12		Cooked	0.580000	1.00	
	14		Boiled	0.580000	1.00	
	32		Canned: Cooked	0.580000	1.00	
	41		Frozen: Raw	0.580000	1.00	
	44		Frozen: Boiled	0.580000	1.00	
	51		Smoked/Cured/Salted/Raw	0.580000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.580000	1.00	
157	11003AD	I	PEPPERS-OTHER			CDFA
	18		Raw: Dried	1.000000	1.00	
159	11005AA	I	TOMATOES-WHOLE			CDFA
	11		Raw	0.500000	1.00	
	12		Cooked	0.500000	1.00	
	14		Boiled	0.500000	1.00	
	15		Fried	0.500000	1.00	
	32		Canned: Cooked	0.500000	1.00	
	34		Canned: Boiled	0.500000	1.00	
	41		Frozen: Raw	0.500000	1.00	
	44		Frozen: Boiled	0.500000	1.00	
165	13001AA	C	BEETS-TOPS(GREENS)			CDFA
	14		Boiled	2.000000	1.00	
168	13005AA	F	BROCCOLI			CDFA
	11		Raw	0.110000	1.00	
	12		Cooked	0.110000	1.00	
	14		Boiled	0.110000	1.00	
	42		Frozen: Cooked	0.110000	1.00	
	44		Frozen: Boiled	0.110000	1.00	
169	13006AA	F	BRUSSELS SPROUTS			CDFA
	14		Boiled	0.790000	1.00	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
170	13007AA	F	CABBAGE-GREEN AND RED			CDFA
	11		Raw	0.480000	1.00	
	12		Cooked	0.480000	1.00	
	14		Boiled	0.480000	1.00	
	32		Canned: Cooked	0.480000	1.00	
	51		Smoked/Cured/Salted/Raw	0.480000	1.00	
173	13010AA	F	CABBAGE-CHINESE/CELERY/BOK CHOY			FDA
	11		Raw	0.240000	1.00	
	12		Cooked	0.240000	1.00	
	14		Boiled	0.240000	1.00	
175	13012AA	F	KOHLRABI			CDFA
	11		Raw	0.050000	1.00	
177	13014AA	E	DANDELION-GREENS			CDFA
	11		Raw	0.060000	1.00	
	14		Boiled	0.060000	1.00	
183	13021AA	F	MUSTARD GREENS			FDA
	11		Raw	0.310000	1.00	
	14		Boiled	0.310000	1.00	
184	13022AA	E	PARSLEY			CDFA
	11		Raw	0.140000	1.00	
	12		Cooked	0.140000	1.00	
	13		Baked	0.140000	1.00	
	18		Raw: Dried	0.140000	1.00	
	32		Canned: Cooked	0.140000	1.00	
	42		Frozen: Cooked	0.140000	1.00	
	43		Frozen: Baked	0.140000	1.00	
186	13024AA	E	SPINACH			CDFA
	11		Raw	0.280000	1.00	
	12		Cooked	0.280000	1.00	
	14		Boiled	0.280000	1.00	
	18		Raw: Dried	0.280000	1.00	
	32		Canned: Cooked	0.280000	1.00	
	41		Frozen: Raw	0.280000	1.00	
	42		Frozen: Cooked	0.280000	1.00	
188	13026AA	C	TURNIPS-TOPS			FDA
	14		Boiled	0.590000	1.00	
	44		Frozen: Boiled	0.590000	1.00	
205	14011AA	D	ONIONS-DRY-BULB (CIPOLLINI)			FDA
	11		Raw	0.030000	1.00	
	12		Cooked	0.030000	1.00	
	18		Raw: Dried	0.030000	1.00	
	32		Canned: Cooked	0.030000	1.00	
	42		Frozen: Cooked	0.030000	1.00	
	51		Smoked/Cured/Salted/Raw	0.030000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.030000	1.00	
212	14014AA	B	RADISHES-ROOTS			FDA
	11		Raw	3.000000	1.00	
	12		Cooked	3.000000	1.00	
218	14018AA	B	SWEET POTATOES (INCLUDING YAMS			CDFA
	13		Baked	0.100000	1.00	
	14		Boiled	0.100000	1.00	
	15		Fried	0.100000	1.00	
	32		Canned: Cooked	0.100000	1.00	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
219	14019AA	B	TURNIPS-ROOTS			FDA
	11		Raw	0.520000	1.00	
	14		Boiled	0.520000	1.00	
	44		Frozen: Boiled	0.520000	1.00	
	51		Smoked/Cured/Salted/Raw	0.520000	1.00	
229	15001AC	G	BEANS-DRY-LIMA			CDFA
	12		Cooked	0.050000	1.00	
	14		Boiled	0.050000	1.00	
234	15003AA	G	BEANS-SUCCULENT-GREEN			FDA
	11		Raw	0.030000	1.00	
	12		Cooked	0.030000	1.00	
	14		Boiled	0.030000	1.00	
	15		Fried	0.030000	1.00	
	18		Raw: Dried	0.030000	1.00	
	19		Cooked: Dried	0.030000	1.00	
	32		Canned: Cooked	0.030000	1.00	
	44		Frozen: Boiled	0.030000	1.00	
238	15005AA	O	CORN/SWEET			FDA
	11		Raw	0.010000	1.00	
	12		Cooked	0.010000	1.00	
	13		Baked	0.010000	1.00	
	14		Boiled	0.010000	1.00	
	32		Canned: Cooked	0.010000	1.00	
	42		Frozen: Cooked	0.010000	1.00	
	44		Frozen: Boiled	0.010000	1.00	
240	15007AA	G	PEAS (GARDEN)-DRY			CDFA
	12		Cooked	0.340000	1.00	
	14		Boiled	0.340000	1.00	
	19		Cooked: Dried	0.340000	1.00	
	32		Canned: Cooked	0.340000	1.00	
241	15009AA	G	PEAS (GARDEN)-GREEN			CDFA
	11		Raw	0.100000	1.00	
	12		Cooked	0.100000	1.00	
	14		Boiled	0.100000	1.00	
	18		Raw: Dried	0.100000	1.00	
	19		Cooked: Dried	0.100000	1.00	
	32		Canned: Cooked	0.100000	1.00	
	34		Canned: Boiled	0.100000	1.00	
	41		Frozen: Raw	0.100000	1.00	
	42		Frozen: Cooked	0.100000	1.00	
	44		Frozen: Boiled	0.100000	1.00	
242	15011AA	G	LENTILS-WHOLE			CDFA
	12		Cooked	0.070000	1.00	
	14		Boiled	0.070000	1.00	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
261	16003AA	A	MUSHROOMS			FDA
	11		Raw	0.001000	1.00	
	12		Cooked	0.001000	1.00	
	14		Boiled	0.001000	1.00	
	15		Fried	0.001000	1.00	
	18		Raw: Dried	0.001000	1.00	
	19		Cooked: Dried	0.001000	1.00	
	32		Canned: Cooked	0.001000	1.00	
	41		Frozen: Raw	0.001000	1.00	
	42		Frozen: Cooked	0.001000	1.00	
	51		Smoked/Cured/Salted/Raw	0.001000	1.00	
266	24002EA	O	CORN/GRAIN-ENDOSPERM			FDA
	12		Cooked	0.010000	1.00	
	13		Baked	0.010000	1.00	
	15		Fried	0.010000	1.00	
	18		Raw: Dried	0.010000	1.00	
	32		Canned: Cooked	0.010000	1.00	
	35		Canned: Fried	0.010000	1.00	
	41		Frozen: Raw	0.010000	1.00	
	42		Frozen: Cooked	0.010000	1.00	
276	24007AA	O	WHEAT-ROUGH			FDA
	12		Cooked	0.090000	1.00	
	13		Baked	0.090000	1.00	
	14		Boiled	0.090000	1.00	
	32		Canned: Cooked	0.090000	1.00	
282	25002SA	B	BEET SUGAR			CDFA
	11		Raw	0.480000	1.00	
	12		Cooked	0.480000	1.00	
	32		Canned: Cooked	0.480000	1.00	
	41		Frozen: Raw	0.480000	1.00	
	51		Smoked/Cured/Salted/Raw	0.480000	1.00	
289	27002OA	O	CORN GRAIN-OIL			FDA
	11		Raw	0.010000	1.00	
	12		Cooked	0.010000	1.00	
	32		Canned: Cooked	0.010000	1.00	
	41		Frozen: Raw	0.010000	1.00	
293	27007OA	A	PEANUTS-OIL			FDA
	11		Raw	0.420000	1.00	
	12		Cooked	0.420000	1.00	
	32		Canned: Cooked	0.420000	1.00	
	41		Frozen: Raw	0.420000	1.00	
304	28023AB	G	SOYBEANS-MATURE SEEDS DRY			FDA
	11		Raw	0.150000	1.00	
	12		Cooked	0.150000	1.00	
	32		Canned: Cooked	0.150000	1.00	
	42		Frozen: Cooked	0.150000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.150000	1.00	
319	50000FA	X	MILK-FAT SOLIDS			FDA
	11		Raw	0.001000	7.87	
	12		Cooked	0.001000	7.87	
	32		Canned: Cooked	0.001000	7.87	
	41		Frozen: Raw	0.001000	7.87	
	42		Frozen: Cooked	0.001000	7.87	
	51		Smoked/Cured/Salted/Raw	0.001000	7.87	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
321	53001BA	U	BEEF-MEAT BYPRODUCTS			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
322	53001BB	U	BEEF(ORGAN MEATS)-OTHER			USDA
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	51		Smoked/Cured/Salted/Raw	0.050000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.050000	1.00	
323	53001DA	U	BEEF-DRIED			USDA
	51		Smoked/Cured/Salted/Raw	0.050000	1.92	
324	53001FA	U	BEEF(BONELESS)-FAT			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	51		Smoked/Cured/Salted/Raw	0.050000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.050000	1.00	
326	53001LA	U	BEEF(ORGAN MEATS)-LIVER			USDA
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
327	53001MA	U	BEEF(BONELESS)-LEAN (FAT/FREE)			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	51		Smoked/Cured/Salted/Raw	0.050000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.050000	1.00	
335	53004AA	U	RABBIT			USDA
	12		Cooked	0.050000	1.00	
338	53005FA	U	SHEEP(BONELESS)-FAT			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
341	53005MA	U	SHEEP(BONELESS)-LEAN (FAT FREE			USDA
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
342	53006BA	U	PORK-MEAT BYPRODUCTS			USDA
	12		Cooked	0.050000	1.00	
	51		Smoked/Cured/Salted/Raw	0.050000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.050000	1.00	
344	53006FA	U	PORK(BONELESS)-FAT			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	51		Smoked/Cured/Salted/Raw	0.050000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.050000	1.00	
346	53006LA	U	PORK(ORGAN MEATS)-LIVER			USDA
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.050000	1.00	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
347	53006MA	U	PORK(BONELESS)-LEAN (FAT FREE)			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	51		Smoked/Cured/Salted/Raw	0.050000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.050000	1.00	
355	55008BA	V	TURKEY-BYPRODUCTS			USDA
	14		Boiled	0.020000	1.00	
	44		Frozen: Boiled	0.020000	1.00	
356	55008LA	V	TURKEY-GIBLETS (LIVER)			USDA
	12		Cooked	0.020000	1.00	
357	55008MA	V	TURKEY-(BONELESS)-FAT			USDA
	11		Raw	0.020000	1.00	
	12		Cooked	0.020000	1.00	
	32		Canned: Cooked	0.020000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.020000	1.00	
358	55008MB	V	TURKEY-(BONELESS)LEAN/FAT FREE			USDA
	11		Raw	0.020000	1.00	
	12		Cooked	0.020000	1.00	
	32		Canned: Cooked	0.020000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.020000	1.00	
360	55013BA	V	POULTRY-OTHER-LEAN (FAT FREE)			USDA
	12		Cooked	0.020000	1.00	
362	55013MA	V	POULTRY-OTHER-FAT			USDA
	12		Cooked	0.020000	1.00	
363	55014AA	X	EGGS-WHOLE			CDFA
	11		Raw	0.200000	1.00	
	12		Cooked	0.200000	1.00	
	32		Canned: Cooked	0.200000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.200000	1.00	
367	55015LA	V	CHICKEN-GIBLETS(LIVER)			USDA
	12		Cooked	0.020000	1.00	
	32		Canned: Cooked	0.020000	1.00	
368	55015MA	V	CHICKEN (BONELESS)-FAT			USDA
	12		Cooked	0.010000	1.00	
	32		Canned: Cooked	0.010000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.010000	1.00	
369	55015MB	V	CHICKEN(BONELESS)LEAN/FAT FREE			USDA
	12		Cooked	0.020000	1.00	
	32		Canned: Cooked	0.020000	1.00	
	52		Smoked/Cured/Salted/Cooked	0.020000	1.00	
385	55015EL	V	CHICKEN-GIBLETS (EXCL. LIVER)			USDA
	12		Cooked	0.020000	1.00	
	14		Boiled	0.020000	1.00	
	43		Frozen: Baked	0.020000	1.00	
398	50000WA	X	MILK-BASED WATER			FDA
	11		Raw	0.001000	1.00	
	12		Cooked	0.001000	1.00	
	32		Canned: Cooked	0.001000	1.00	
	41		Frozen: Raw	0.001000	1.00	
	42		Frozen: Cooked	0.001000	1.00	
	51		Smoked/Cured/Salted/Raw	0.001000	1.00	

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
403	15006BT	A	PEANUT-BUTTER			FDA
	11		Raw	0.420000	1.89	
	12		Cooked	0.420000	1.89	
	13		Baked	0.420000	1.89	
417	15018HA	A	SUNFLOWER-SEEDS-HULLED			FDA
	13		Baked	0.190000	1.00	
	18		Raw: Dried	0.190000	1.00	
424	56000FA	U	VEAL-(BONELESS)-FAT			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	13		Baked	0.050000	1.00	
	15		Fried	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	42		Frozen: Cooked	0.050000	1.00	
	43		Frozen: Baked	0.050000	1.00	
	44		Frozen: Boiled	0.050000	1.00	
	45		Frozen: Fried	0.050000	1.00	
425	56000MA	U	VEAL-(BONELESS)-LEAN (FAT FREE			USDA
	11		Raw	0.050000	1.00	
	12		Cooked	0.050000	1.00	
	13		Baked	0.050000	1.00	
	15		Fried	0.050000	1.00	
	32		Canned: Cooked	0.050000	1.00	
	42		Frozen: Cooked	0.050000	1.00	
	43		Frozen: Baked	0.050000	1.00	
	44		Frozen: Boiled	0.050000	1.00	
	45		Frozen: Fried	0.050000	1.00	
431	030090L	R	WALNUT OIL			CDFA
	11		Raw	0.200000	1.00	
441	02002JC	K	GRAPEFRUIT-JUICE-CONCENTRATE			CDFA
	41		Frozen: Raw	0.250000	8.26	
442	02004JC	K	LEMONS-JUICE-CONCENTRATE			CDFA
	41		Frozen: Raw	0.390000	11.40	
443	02005JC	K	LIMES-JUICE-CONCENTRATE			CDFA
	41		Frozen: Raw	0.060000	6.00	
448	02002HA	K	GRAPEFRUIT PEEL			CDFA
	12		Cooked	0.250000	1.00	
449	NOCODE	V	TURKEY-(ORGAN MEATS)-OTHER			USDA
	52		Smoked/Cured/Salted/Cooked	0.020000	1.00	
940	NOCODE	A	PEANUTS HULLED			FDA
	11		Raw	0.420000	1.00	
	12		Cooked	0.420000	1.00	
	13		Baked	0.420000	1.00	
	14		Boiled	0.420000	1.00	
	15		Fried	0.420000	1.00	
	41		Frozen: Raw	0.420000	1.00	
	43		Frozen: Baked	0.420000	1.00	
	45		Frozen: Fried	0.420000	1.00	

CDFA- California Department of Food and Agriculture
FDA- United States Food and Drug Administration
USDA- United States Department of Agriculture
FS- Field Study, Iwata, Y., J.R. O'Neal, J.H. Barkley, T.M. Dinoff, and M.E. Dusch, 1983. Chlorpyrifos applied to California citrus: Residue levels on foliage and on and in fruit. J. Agric. Food Chem. 31(3):603-610.

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
DATE RESIDUE FILE CREATED OR LAST UPDATED: 10-05-1991/09:55:43
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

U.S. POP - ALL SEASONS

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
99.7%	0.001088	459

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000179	2795	20.0	0.001606	311
80.0	0.000300	1668	10.0	0.002446	204
70.0	0.000415	1206	5.0	0.003313	151
60.0	0.000548	912	2.5	0.004429	113
50.0	0.000696	719	1.0	0.006645	75
40.0	0.000889	562	0.5	0.008480	59
30.0	0.001188	421	0.0	0.028347	18

WESTERN REGION

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
100.0%	0.001149	435

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000167	2993	20.0	0.001697	295
80.0	0.000288	1738	10.0	0.002710	185
70.0	0.000407	1227	5.0	0.003726	134
60.0	0.000550	909	2.5	0.004846	103
50.0	0.000723	692	1.0	0.006749	74
40.0	0.000978	511	0.5	0.007689	65
30.0	0.001314	381	0.0	0.011692	43

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

HISPANICS

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
99.8%	0.001008	496

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000125	3992	20.0	0.001524	328
80.0	0.000264	1892	10.0	0.002098	238
70.0	0.000404	1239	5.0	0.003031	165
60.0	0.000534	937	2.5	0.004024	124
50.0	0.000673	743	1.0	0.006560	76
40.0	0.000837	598	0.5	0.008367	60
30.0	0.001167	428	0.0	0.010896	46

NON-HISPANIC WHITES

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
99.8%	0.001094	457

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000184	2713	20.0	0.001611	310
80.0	0.000305	1639	10.0	0.002442	205
70.0	0.000419	1192	5.0	0.003298	152
60.0	0.000555	901	2.5	0.004433	113
50.0	0.000706	709	1.0	0.006688	75
40.0	0.000895	558	0.5	0.008619	58
30.0	0.001193	419	0.0	0.028347	18

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

NON-HISPANIC BLACKS

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
99.5%	0.001048	477

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000165	3023	20.0	0.001536	326
80.0	0.000277	1807	10.0	0.002356	212
70.0	0.000384	1302	5.0	0.003398	147
60.0	0.000504	991	2.5	0.004534	110
50.0	0.000639	782	1.0	0.006422	78
40.0	0.000845	592	0.5	0.008110	62
30.0	0.001125	445	0.0	0.016441	30

NON-HISPANIC OTHER

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
99.1%	0.001228	407

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000195	2559	20.0	0.001764	283
80.0	0.000324	1543	10.0	0.002981	168
70.0	0.000447	1118	5.0	0.003552	141
60.0	0.000589	849	2.5	0.004801	104
50.0	0.000749	667	1.0	0.006903	72
40.0	0.001010	495	0.5	0.007818	64
30.0	0.001362	367	0.0	0.021938	23

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

NURSING INFANTS (<1 YEAR)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
77.4%	0.002793	179

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000108	4633	20.0	0.006039	83
80.0	0.000332	1506	10.0	0.008239	61
70.0	0.000579	864	5.0	0.009568	52
60.0	0.000756	661	2.5	0.010232	49
50.0	0.001316	380	1.0	0.010631	47
40.0	0.001678	298	0.5	0.010764	46
30.0	0.004119	121	0.0	0.010896	46

NON-NURSING INFANTS (<1)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
89.0%	0.002201	227

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000129	3880	20.0	0.003729	134
80.0	0.000281	1780	10.0	0.006188	81
70.0	0.000601	832	5.0	0.007671	65
60.0	0.000803	623	2.5	0.009806	51
50.0	0.001015	492	1.0	0.012704	39
40.0	0.001411	354	0.5	0.016119	31
30.0	0.002413	207	0.0	0.024257	21

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

FEMALES (13+/PREG/NOT NSG)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
99.5%	0.000806	621

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000150	3340	20.0	0.001151	434
80.0	0.000249	2008	10.0	0.001649	303
70.0	0.000355	1409	5.0	0.002734	183
60.0	0.000464	1079	2.5	0.003575	140
50.0	0.000583	857	1.0	0.004165	120
40.0	0.000718	696	0.5	0.004362	115
30.0	0.000852	587	0.0	0.004521	111

FEMALES (13+/NURSING)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
100.0%	0.000934	535

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000196	2547	20.0	0.001556	321
80.0	0.000350	1428	10.0	0.001933	259
70.0	0.000510	981	5.0	0.002509	199
60.0	0.000627	797	2.5	0.002828	177
50.0	0.000704	710	1.0	0.004019	124
40.0	0.000780	641	0.5	0.004886	102
30.0	0.001092	458	0.0	0.005733	87

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

CHILDREN (1-6 YEARS)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
100.0%	0.002231	224

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000285	1754	20.0	0.003467	144
80.0	0.000615	813	10.0	0.005340	94
70.0	0.000893	560	5.0	0.006940	72
60.0	0.001177	425	2.5	0.008711	57
50.0	0.001479	338	1.0	0.011201	45
40.0	0.001940	258	0.5	0.013959	36
30.0	0.002557	196	0.0	0.028347	18

CHILDREN (7-12 YEARS)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY MG/KG BODY WT/DAY	MARGIN OF SAFTEY
100.0%	0.001609	311

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000342	1462	20.0	0.002461	203
80.0	0.000530	944	10.0	0.003663	136
70.0	0.000717	698	5.0	0.004625	108
60.0	0.000903	554	2.5	0.005848	86
50.0	0.001115	449	1.0	0.007551	66
40.0	0.001387	361	0.5	0.009773	51
30.0	0.001852	270	0.0	0.018530	27

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

MALES (13-19 YEARS)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
100.0%	0.000970	515

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000226	2210	20.0	0.001458	343
80.0	0.000339	1477	10.0	0.002204	227
70.0	0.000459	1090	5.0	0.002857	175
60.0	0.000588	851	2.5	0.003582	140
50.0	0.000719	695	1.0	0.004358	115
40.0	0.000869	576	0.5	0.004750	105
30.0	0.001096	456	0.0	0.007220	69

FEMALES (13-19 YRS/NP/NN)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
100.0%	0.001005	498

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000148	3371	20.0	0.001359	368
80.0	0.000276	1811	10.0	0.002074	241
70.0	0.000385	1299	5.0	0.002934	170
60.0	0.000496	1008	2.5	0.004376	114
50.0	0.000613	816	1.0	0.008267	60
40.0	0.000779	641	0.5	0.009169	55
30.0	0.000984	508	0.0	0.016266	31

EXPOSURE ANALYSIS FOR Chlorpyrifos
RESIDUE FILE NAME: CLORPYRA DATE OF ANALYSIS: 03-18-1991
REFERENCE DOSE = 0.500000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, tolerances, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

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MALES (20+ YEARS)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
99.7%	0.000851	588

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000181	2755	20.0	0.001310	382
80.0	0.000288	1737	10.0	0.001875	267
70.0	0.000391	1279	5.0	0.002444	205
60.0	0.000489	1022	2.5	0.002964	169
50.0	0.000613	815	1.0	0.003656	137
40.0	0.000771	648	0.5	0.004270	117
30.0	0.001009	496	0.0	0.010668	47

FEMALES (20+ YEARS/NP/NN)

ESTIMATED % OF POTENTIAL PERSON-DAYS THAT ARE USER-DAYS	MEAN DAILY EXPOSURE PER USER-DAY: MG/KG BODY WT/DAY	MEAN DAILY EXPOSURE PER USER-DAY: MARGIN OF SAFTEY
99.9%	0.000873	573

ESTIMATED PERCENTILE OF POPULATION USER-DAYS EXCEEDING CALCULATED EXPOSURE IN MG/KG BODY WT/DAY AND CORRESPONDING MARGIN OF SAFETY (MOS)

PERCENTILE	EXPOSURE	MOS	PERCENTILE	EXPOSURE	MOS
90.0	0.000154	3255	20.0	0.001365	366
80.0	0.000255	1960	10.0	0.002081	240
70.0	0.000353	1415	5.0	0.002631	190
60.0	0.000465	1075	2.5	0.003314	151
50.0	0.000589	849	1.0	0.004201	119
40.0	0.000743	673	0.5	0.005086	98
30.0	0.001006	497	0.0	0.013868	36

CHRONIC EXPOSURE ANALYSIS FOR Chlorpyrifos: AB 2161 (Bronzan) Dietary Assessment
RESIDUE FILE NAME: CLORPYRC
DATE RESIDUE FILE CREATED OR LAST UPDATED: 10-05-1991/09:05:34
REFERENCE DOSE (RfD) = 1.000000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys, and field studies
COMMENT 2: All label approved direct food uses and secondary residues

TOTAL EXPOSURE BY POPULATION SUBGROUP

POPULATION SUBGROUP	TOTAL EXPOSURE MG/KG BODY WT/DAY	MARGIN OF SAFETY	PERCENT OF CDFA NOEL
U.S. POP - 48 STATES - ALL SEASONS	0.000193	5181	0.02%
U.S. POPULATION - SPRING SEASON	0.000186	5376	0.02%
U.S. POPULATION - SUMMER SEASON	0.000198	5051	0.02%
U.S. POPULATION - AUTUMN SEASON	0.000192	5208	0.02%
U.S. POPULATION - WINTER SEASON	0.000197	5076	0.02%
NORTHEAST REGION	0.000196	5102	0.02%
NORTH CENTRAL REGION	0.000191	5236	0.02%
SOUTHERN REGION	0.000192	5208	0.02%
WESTERN REGION	0.000194	5155	0.02%
HISPANICS	0.000188	5319	0.02%
NON-HISPANIC WHITES	0.000189	5291	0.02%
NON-HISPANIC BLACKS	0.000210	4762	0.02%
NON-HISPANIC OTHER THAN BLACK OR WHITE	0.000226	4425	0.02%
NURSING INFANTS (<1 YEAR OLD)	0.000124	8065	0.01%
NON-NURSING INFANTS (<1 YEAR OLD)	0.000359	2786	0.04%
FEMALES (13+/PREGNANT/NOT NURSING)	0.000145	6897	0.01%
FEMALES (13+/NURSING)	0.000168	5952	0.02%
CHILDREN (1-6 YEARS)	0.000455	2198	0.05%
CHILDREN (7-12 YEARS)	0.000296	3378	0.03%
MALES (13-19 YEARS)	0.000188	5319	0.02%
FEMALES (13-19 YRS/NOT PREG. OR NURSING)	0.000169	5917	0.02%
MALES (20+ YEARS)	0.000149	6711	0.01%
FEMALES (20+ YEARS/NOT PREG. OR NURSING)	0.000143	6993	0.01%

APPENDIX D

Chronic Dietary Exposure Analysis

and

Residue File

EXPOSURE 1-87 ANALYSIS FOR Chlorpyrifos DATE: 03-18-1991
RESIDUE FILE NAME: CLORPYRC
DATE RESIDUE FILE CREATED OR LAST UPDATED: 03-18-1991/09:05:34
REFERENCE DOSE (RfD) = 1.000000 MG/KG BODY WT/DAY
COMMENT 1: Residues from CDFA, FDA, USDA surveys
COMMENT 2: All label approved direct food uses and secondary residues

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
7	01009AA	N	BLUEBERRIES	0.025000	1.00	CDFA
8	01010AA	N	CRANBERRIES	0.115000	1.00	CDFA, FDA
13	01014AA	N	GRAPES	0.026000	1.00	CDFA, FDA
14	01014DA	N	GRAPES-RAISINS	0.048000	1.00	CDFA
17	01016AA	N	STRAWBERRIES	0.024000	1.00	CDFA, FDA
20	02001AA	K	CITRUS CITRON	0.026000	1.00	CDFA
22	02002AB	K	GRAPEFRUIT-PEELED FRUIT	0.027000	1.00	CDFA, FDA
23	02002JA	K	GRAPEFRUIT-JUICE	0.027000	2.10	CDFA, FDA
24	02003AA	K	KUMQUATS	0.025000	1.00	CDFA, FDA
26	02004AB	K	LEMONS-PEELED FRUIT	0.025000	1.00	CDFA, FDA
27	02004HA	K	LEMONS-PEEL	0.025000	1.00	CDFA, FDA
28	02004JA	K	LEMONS-JUICE	0.025000	2.00	CDFA, FDA
30	02005AB	K	LIMES-PEELED FRUIT	0.025000	1.00	CDFA
31	02005HA	K	LIMES-PEEL	0.025000	1.00	CDFA
32	02005JA	K	LIMES-JUICE	0.025000	2.00	CDFA
33	02006JC	K	ORANGES-JUICE-CONCENTRATE	0.001500	6.70	Field Study
34	02006AB	K	ORANGES-PEELED FRUIT	0.001500	1.00	Field Study
35	02006HA	K	ORANGES-PEEL	0.112500	1.00	CDFA, FDA
36	02006JA	K	ORANGES-JUICE	0.001500	1.80	Field Study
37	02007AA	K	TANGELOS	0.025000	1.00	CDFA, FDA
38	02008AA	K	TANGERINES	0.025000	1.00	CDFA, FDA
39	02008JA	K	TANGERINES-JUICE	0.025000	2.30	CDFA, FDA
40	03001AA	R	ALMONDS	0.104000	1.00	CDFA
41	03002AA	R	BRAZIL NUTS	0.025000	1.00	CDFA
42	03003AA	R	CASHEWS	0.025000	1.00	CDFA
43	03004AA	R	CHESTNUTS	0.025000	1.00	CDFA
44	03005AA	R	FILBERTS (HAZELNUTS)	0.025000	1.00	CDFA
45	03006AA	R	HICKORY NUTS	0.025000	1.00	CDFA
46	03007AA	R	MACADAMIA NUTS (BUSH NUTS)	0.025000	1.00	CDFA
47	03008AA	R	PECANS	0.025000	1.00	CDFA
48	03009AA	R	WALNUTS	0.025000	1.00	CDFA
49	03010AA	R	BUTTER NUTS	0.200000	1.00	CDFA
51	03013AA	R	BEECHNUTS	0.025000	1.00	CDFA
52	04001AA	L	APPLES	0.031700	1.00	CDFA, FDA
56	04003AA	L	PEARS	0.024500	1.00	CDFA, FDA
58	04004AA	L	QUINCES	0.026000	1.00	CDFA
59	05001AA	M	APRICOTS	0.025000	1.00	CDFA
61	05002AA	M	CHERRIES	0.023700	1.00	CDFA, FDA
64	05003AA	M	NECTARINES	0.026600	1.00	CDFA, FDA
65	05004AA	M	PEACHES	0.039000	1.00	CDFA, FDA
67	05005AA	M	PLUMS(DAMSONS)	0.024800	1.00	CDFA, FDA
68	05005DA	M	PLUMS-PRUNES(DRIED)	0.025000	1.00	CDFA, FDA
72	06002AB	A	BANANAS	0.025000	1.00	CDFA
77	06004AA	A	DATES	0.025000	1.00	CDFA
78	06005AA	A	FIGS	0.026000	1.00	CDFA
97	06018AA	A	KIWI FRUIT	0.028000	1.00	CDFA

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RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
107	06030AA	A	CHERIMOYA	0.025000	1.00	CDFA
148	10010AA	J	CUCUMBERS	0.025000	1.00	CDFA, FDA
149	10011AA	J	PUMPKIN	0.025000	1.00	CDFA
155	11003AA	I	PEPPERS-SWEET(GARDEN)	0.038000	1.00	CDFA, FDA
157	11003AD	I	PEPPERS-OTHER	0.034000	1.00	CDFA, FDA
159	11005AA	I	TOMATOES-WHOLE	0.029000	1.00	CDFA, FDA
165	13001AA	C	BEETS-TOPS(GREENS)	0.025000	1.00	CDFA
168	13005AA	F	BROCCOLI	0.025000	1.00	CDFA, FDA
169	13006AA	F	BRUSSELS SPROUTS	0.031000	1.00	CDFA, FDA
170	13007AA	F	CABBAGE-GREEN AND RED	0.025000	1.00	CDFA, FDA
173	13010AA	F	CABBAGE-CHINESE/CELERY/BOK CHO	0.026000	1.00	CDFA, FDA
175	13012AA	F	KOHLRABI	0.025000	1.00	CDFA
177	13014AA	E	DANDELION-GREENS	0.025000	1.00	CDFA
183	13021AA	F	MUSTARD GREENS	0.027000	1.00	CDFA, FDA
184	13022AA	E	PARSLEY	0.024700	1.00	CDFA, FDA
186	13024AA	E	SPINACH	0.025000	1.00	CDFA, FDA
188	13026AA	C	TURNIPS-TOPS	0.035000	1.00	CDFA, FDA
204	14010AA	D	LEEKS	0.025000	1.00	CDFA
205	14011AA	D	ONIONS-DRY-BULB (CIPOLLINI)	0.025000	1.00	CDFA, FDA
212	14014AA	B	RADISHES-ROOTS	0.042000	1.00	CDFA, FDA
214	14015AA	B	RUTABAGAS-ROOTS	0.032000	1.00	CDFA, FDA
218	14018AA	B	SWEET POTATOES (INCLUDING YAMS	0.025000	1.00	CDFA
219	14019AA	B	TURNIPS-ROOTS	0.069000	1.00	CDFA, FDA
229	15001AC	G	BEANS-DRY-LIMA	0.025000	1.00	CDFA
234	15003AA	G	BEANS-SUCCULENT-GREEN	0.025000	1.00	CDFA, FDA
238	15005AA	O	CORN/SWEET	0.024000	1.00	CDFA, FDA
239	15006AA	A	PEANUTS-WHOLE	0.123000	1.00	CDFA, FDA
240	15007AA	G	PEAS (GARDEN)-DRY	0.032000	1.00	CDFA, FDA
241	15009AA	G	PEAS (GARDEN)-GREEN	0.032000	1.00	CDFA
242	15011AA	G	LENTILS-WHOLE	0.025000	1.00	CDFA
253	15027AA	G	BEANS-UNSPECIFIED	0.030000	1.00	CDFA, FDA
261	16003AA	A	MUSHROOMS	0.001000	1.00	CDFA, FDA
266	24002EA	O	CORN/GRAIN-ENDOSPERM	0.025000	1.00	CDFA, FDA
276	24007AA	O	WHEAT-ROUGH	0.015000	1.00	FDA
282	25002SA	B	BEET SUGAR	0.031000	1.00	CDFA, FDA
289	27002OA	O	CORN GRAIN-OIL	0.025000	1.00	CDFA, FDA
293	27007OA	A	PEANUTS-OIL	0.123000	1.00	CDFA, FDA
304	28023AB	G	SOYBEANS-MATURE SEEDS DRY	0.025000	1.00	CDFA, FDA
319	50000FA	X	MILK-FAT SOLIDS	0.001000	7.87	FDA
321	53001BA	U	BEEF-MEAT BYPRODUCTS	0.025000	1.00	USDA
322	53001BB	U	BEEF(ORGAN MEATS)-OTHER	0.025000	1.00	USDA
323	53001DA	U	BEEF-DRIED	0.025000	1.92	USDA
324	53001FA	U	BEEF(BONELESS)-FAT	0.025000	1.00	USDA
325	53001KA	U	BEEF(ORGAN MEATS)-KIDNEY	0.025000	1.00	USDA
326	53001LA	U	BEEF(ORGAN MEATS)-LIVER	0.025000	1.00	USDA
327	53001MA	U	BEEF(BONELESS)-LEAN (FAT/FREE)	0.025000	1.00	USDA
328	53002BA	U	GOAT-MEAT BYPRODUCTS	0.025000	1.00	USDA
329	53002BB	U	GOAT(ORGAN MEATS)-OTHER	0.025000	1.00	USDA
330	53002FA	U	GOAT(BONELESS)-FAT	0.025000	1.00	USDA
331	53002KA	U	GOAT(ORGAN MEATS)-KIDNEY	0.025000	1.00	USDA
332	53002LA	U	GOAT(ORGAN MEATS)-LIVER	0.025000	1.00	USDA
333	53002MA	U	GOAT(BONELESS)-LEAN (FAT/FREE)	0.025000	1.00	USDA

RESIDUE FILE LISTING

TAS CODE	EPA CODE	CROP GRP	FOOD NAME	RESIDUE (PPM)	ADJ FCTR	DATA SOURCE
334	53003AA	U	HORSE	0.025000	1.00	USDA
335	53004AA	U	RABBIT	0.025000	1.00	USDA
336	53005BA	U	SHEEP-MEAT BYPRODUCTS	0.025000	1.00	USDA
337	53005BB	U	SHEEP(ORGAN MEATS)-OTHER	0.025000	1.00	USDA
338	53005FA	U	SHEEP(BONELESS)-FAT	0.025000	1.00	USDA
339	53005KA	U	SHEEP(ORGAN MEATS)-KIDNEY	0.025000	1.00	USDA
340	53005LA	U	SHEEP(ORGAN MEATS)-LIVER	0.025000	1.00	USDA
341	53005MA	U	SHEEP(BONELESS)-LEAN (FAT FREE	0.025000	1.00	USDA
342	53006BA	U	PORK-MEAT BYPRODUCTS	0.025000	1.00	USDA
343	53006BB	U	PORK(ORGAN MEATS)-OTHER	0.025000	1.00	USDA
344	53006FA	U	PORK(BONELESS)-FAT	0.025000	1.00	USDA
345	53006KA	U	PORK(ORGAN MEATS)-KIDNEY	0.025000	1.00	USDA
346	53006LA	U	PORK(ORGAN MEATS)-LIVER	0.025000	1.00	USDA
347	53006MA	U	PORK(BONELESS)-LEAN (FAT FREE)	0.025000	1.00	USDA
355	55008BA	V	TURKEY-BYPRODUCTS	0.010000	1.00	USDA
356	55008LA	V	TURKEY-GIBLETS (LIVER)	0.010000	1.00	USDA
357	55008MA	V	TURKEY-(BONELESS)-FAT	0.010000	1.00	USDA
358	55008MB	V	TURKEY-(BONELESS)LEAN/FAT FREE	0.010000	1.00	USDA
359	55008MC	V	TURKEY-UNSPECIFIED	0.010000	1.00	USDA
360	55013BA	V	POULTRY-OTHER-LEAN (FAT FREE)	0.010000	1.00	USDA
361	55013LA	V	POULTRY-OTHER-GIBLETS(LIVER)	0.010000	1.00	USDA
362	55013MA	V	POULTRY-OTHER-FAT	0.010000	1.00	USDA
363	55014AA	X	EGGS-WHOLE	0.025000	1.00	CDFA
366	55015BA	V	CHICKEN-BYPRODUCTS	0.010000	1.00	USDA
367	55015LA	V	CHICKEN-GIBLETS(LIVER)	0.010000	1.00	USDA
368	55015MA	V	CHICKEN (BONELESS)-FAT	0.010000	1.00	USDA
369	55015MB	V	CHICKEN(BONELESS)LEAN/FAT FREE	0.010000	1.00	USDA
385	55015EL	V	CHICKEN-GIBLETS (EXCL. LIVER)	0.010000	1.00	USDA
398	50000WA	X	MILK-BASED WATER	0.001000	1.00	FDA
403	15006BT	A	PEANUT-BUTTER	0.123000	1.89	CDFA, FDA
417	15018HA	A	SUNFLOWER-SEEDS-HULLED	0.025000	1.00	CDFA, FDA
420	02008JC	K	TANGERINES-JUICE-CONCENTRATE	0.036000	7.35	CDFA, FDA
424	56000FA	U	VEAL-(BONELESS)-FAT	0.025000	1.00	USDA
425	56000MA	U	VEAL-(BONELESS)-LEAN (FAT FREE	0.025000	1.00	USDA
426	56000KA	U	VEAL-(ORGAN MEATS)-KIDNEY	0.025000	1.00	USDA
427	56000LA	U	VEAL-(ORGAN MEATS)-LIVER	0.025000	1.00	USDA
428	56000BB	U	VEAL-(ORGAN MEATS)-OTHER	0.025000	1.00	USDA
429	56000DA	U	VEAL-DRIED	0.025000	1.92	USDA
430	56000BA	U	VEAL-MEAT BYPRODUCTS	0.025000	1.00	USDA
431	030090L	R	WALNUT OIL	0.062000	1.00	CDFA
441	02002JC	K	GRAPEFRUIT-JUICE-CONCENTRATE	0.027000	8.26	CDFA, FDA
442	02004JC	K	LEMONS-JUICE-CONCENTRATE	0.025000	11.40	CDFA, FDA
443	02005JC	K	LIMES-JUICE-CONCENTRATE	0.025000	6.00	CDFA
448	02002HA	K	GRAPEFRUIT PEEL	0.027000	1.00	CDFA, FDA
449	NOCODE	V	TURKEY-(ORGAN MEATS)-OTHER	0.010000	1.00	USDA
940	NOCODE	A	PEANUTS HULLED	0.123000	1.00	CDFA, FDA

CDFA- California Department of Food and Agriculture
FDA- United States Food and Drug Administration
USDA- United States Department of Agriculture
Field Study- Iwata, Y., J.R. O'Neal, J.H. Barkley, T.M. Dinoff, and M.E. Dusch, 1983. Chlorpyrifos applied to California citrus: Residue levels on foliage and on and in fruit. J. Agric. Food Chem. 31(3):603-610.